Public Health Assessment for

STAUFFER CHEMICAL

13-0

10013760

For Public Comment

PUBLIC HEALTH ASSESSMENT ADDENDUM
STAUFFER CHEMICAL COMPANY (TARPON SPRINGS)
TARPON SPRINGS, PINELLAS COUNTY, FLORIDA
CERCLIS NO. FLD010596013
JANUARY 21, 1999

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

Comment Period Ends:

MARCH 7, 1999

PUBLIC HEALTH ASSESSMENT ADDENDUM

Stauffer Chemical Superfund Site Vicinity Properties

STAUFFER CHEMICAL COMPANY (TARPON SPRINGS)

TARPON SPRINGS, PINELLAS COUNTY, FLORIDA

CERCLIS NO. FLD010596013

Prepared by:

Energy Section
Federal Facilities Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment-Public Comment Release was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate. This document represents the agency's best efforts, based on currently available information, to fulfill the statutory criteria set out in CERCLA section 104 (i)(6) within a limited time frame. To the extent possible, it presents an assessment of potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. In addition, ATSDR will utilize this document to determine if follow-up health actions are appropriate at this time.

This document has previously been provided to EPA and the affected state in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. Where necessary, it has been revised in response to comments or additional relevant information provided by them to ATSDR. This revised document has now been released for a 30-day public comment period. Subsequent to the public comment period, ATSDR will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued. This will conclude the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

Agency for Toxic Substances and Disease Registry .... Jeffrey P. Koplan, M.D., M.P.H., Administrator
Barry L. Johnson, Ph.D., Assistant Administrator

Division of Health Assessment and Consultation .... Robert C. Williams, P.E., DEE, Director
Sharon Williams-Fleetwood, Ph.D., Deputy Director

Community Involvement Branch .... Germano E. Pereira, Chief

Exposure Investigations and Consultation Branch.............................. John E. Abraham, Ph.D, Chief

Federal Facilities Assessment Branch.. Sandra G. Isaacs, Chief

Program Evaluation, Records, and Information .... Max M. Howie, Jr., M.S., Chief

Superfund Site Assessment Branch.. Acting Branch Chief

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

Please address comments regarding this report to:

Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Attn: Chief, Program Evaluation, Records, and Information Services Branch, E-56
1600 Clifton Road, N.E., Atlanta, Georgia 30333

Additional copies of this report are available from:
National Technical Information Service, Springfield, Virginia
(703) 605-6000

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR or
Visit our Home Page at: http://atsdr1.atsdr.cdc.gov:8080/

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-

TABLE OF CONTENTS

TABLES

FIGURE

SUMMARY

From 1947 to 1981, the Stauffer Chemical Company in Tarpon Springs, Florida, made elemental phosphorus from phosphate ore. While the plant was in operation, phosphate slag was transported off site and used as aggregate in road bedding, road and driveway paving, and in concrete structures. The extent of the distribution could not be determined. Residents in the area expressed concern about possible adverse health effects resulting from exposure to radium and heavy metals leaching from phosphate slag that was used in nearby roads and buildings. Besides radium, other contaminants of concern to residents were arsenic, asbestos, uranium, radon, and ionizing radiation.

There is a completed exposure to ionizing radiation from radium contaminated slag and aggregate, and exposures are not expected to result in any adverse health outcomes, however the levels of ionizing radiation at one residence exceed both national and international guidelines for exposure by a factor of two.

Contaminated slag contains concentrations of metals above background levels, but does not appear to represent a public health hazard. Combined exposures from roads and driveways are not a health threat. ATSDR recommends that public health education be provided, to help the public better understand that there is no public health hazard posed by the phosphate slag.

BACKGROUND

In February 1998, the Agency for Toxic Substances and Disease Registry (ATSDR) received a petition from a Tarpon Springs, Florida, resident. The person requested that the agency investigate health problems that might be associated with exposure to slag materials used in residential areas of Tarpon Springs. Since then, ATSDR has responded to letters from several other residents. The U.S. Environmental Protection Agency (EPA), Region IV also requested that ATSDR review the sampling data taken at several vicinity properties near the Stauffer Superfund site in Tarpon Springs. EPA asked ATSDR to review chemical and radiological sampling data of residential slag, to evaluate exposure scenarios, to provide radiological dose estimates, and to make recommendations for protection of public health.

Since receiving letters from concerned Tarpon Springs' residents, ATSDR staff members have begun investigating residents' health concerns and possible associations between those concerns and exposures to hazardous substances.

A. Site Description and History

From 1947 to 1981, the Stauffer Chemical Company (which operated under different ownership until 1960) made elemental phosphorus from phosphate ore using an arc furnace process. The processed ore was shipped off site to produce agricultural products, food-grade phosphates, and flame retardants. While the chemical plant operated, waste products (i.e., slag) were disposed of on the plant property, shipped off site by rail, and were given to local residents to be used as fill and aggregate.

The Stauffer plant was added to the EPA Superfund list in 1994 because of pollution on the site. Superfund is a federal program for finding and cleaning up hazardous waste sites in this country. Since 1994, EPA has been working to clean up the Stauffer site. EPA is testing and monitoring the soil, water, and air at the site and at vicinity properties to protect nearby residents against health problems that might result from exposure to hazardous waste.

B. Site Visit

In May 1998, ATSDR staff members visited Tarpon Springs to meet with residents and to gather more information. Staff members addressed residents' questions. ATSDR and EPA Region IV personnel visited several vicinity properties in Tarpon Springs and Holiday, Florida. They saw the Stauffer Chemical Superfund site from the site boundary including the Anclote River. During a boat tour on the Anclote River, ATSDR and EPA were shown where slag from the site was used to fill in an inlet on site property.

In August 1998, EPA Region IV personnel and staff from EPA's National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama, took samples of building materials and roads and performed radiological surveys of several vicinity properties.

C. Demographics, Land Use and Natural Resources

The City of Tarpon Springs is in Pinellas County, Florida. The community is near the Anclote River, about 1.6 miles east of the Gulf of Mexico. Gulfside Elementary School is directly across the street from the Stauffer site and Tarpon Springs Middle and High Schools are also in close proximity.

According to 1990 census data (1), 9,231 people live within a one-mile radius of the site. About 97% of the population is white and 2.2% are black, with most being middle income level. A hospital, a nursing home, and a children's group home are within one mile of the site. There are about 100 private wells within this same area. The color maps on the following page give a graphical representation of the demographic data (see figure 1).

D. Health Outcome Data

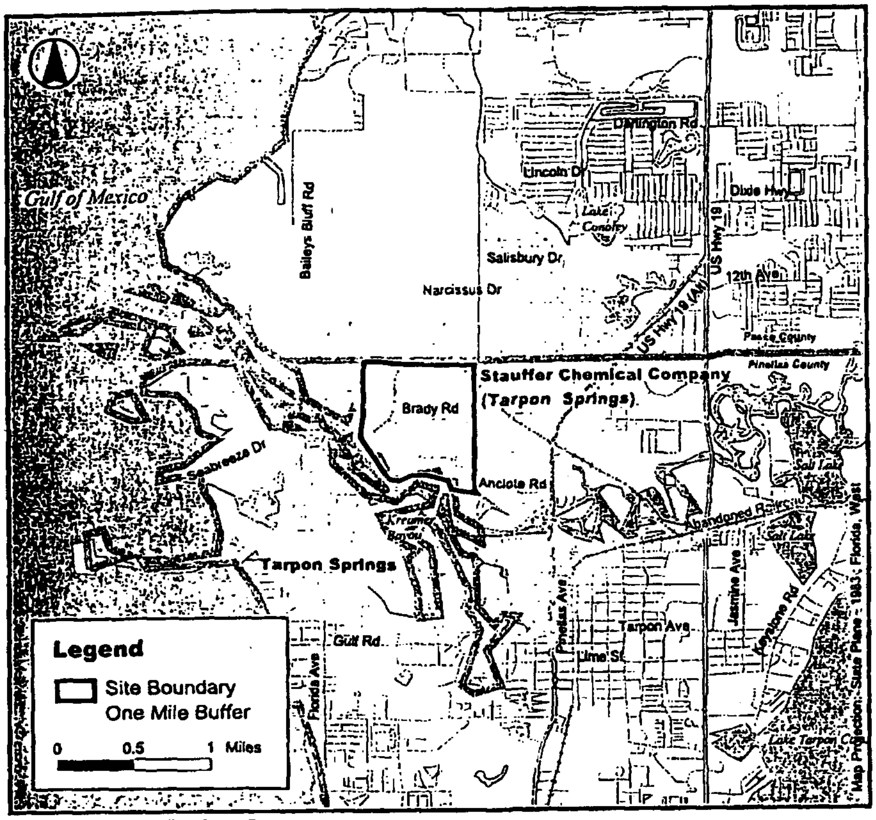
Evaluation of available health outcome data did not find any elevated mortality rates for leukemia, bone cancer, or respiratory diseases. Rates for Pasco and Pinellas Counties were below the state averages for both respiratory disease and childhood leukemia and bone cancers.

Mortality data were analyzed for various respiratory diseases (ICD Codes 460 to 519.9) and for childhood radiogenic cancers (ICD Codes 204 to 204.9) in Florida counties surrounding the Stauffer site. Respiratory diseases were looked at, because of the dusts emitted from Stauffer Chemical when it was operating. ATSDR used the *Wide-ranging ONline Data for Epidemiologic Research (WONDER)* system, which is a computer database designed by the Information Resources Management Office, Centers for Disease Control and Prevention (CDC), Public Health Service. The mortality section of the database provided information for comparing the rates of the county with rates for the state and the rest of the country.

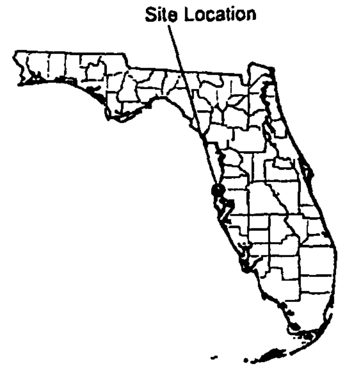
Stauffer Chemical Company (Tarpon Springs)

Tarpon Springs, Florida

CERCLIS No. FLD010596013



Base Map Source: 1995 TIGER/Line Files



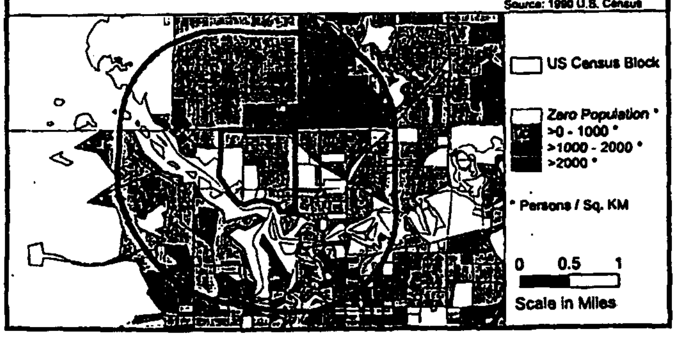
Pinellas County, Florida

Demographic Statistics Within One Mile of Site*	
Total Population	9231
White	8936
Black	208
American Indian, Eskimo, Aleut	26
Asian or Pacific Islander	35
Other Race	23
Hispanic Origin	208
Children Aged 6 and Younger	549
Adults Aged 65 and Older	2940
Females Aged 15 - 44	1465
Total Housing Units	4906

Demographics Statistics Source: 1990 U.S. Census
*Calculated using an area-proportion spatial analysis technique

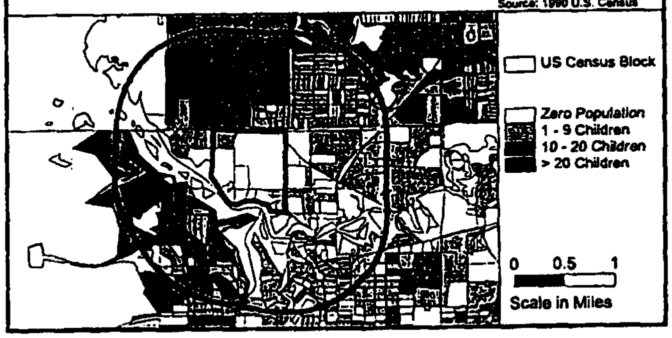
Population Density

Source: 1990 U.S. Census



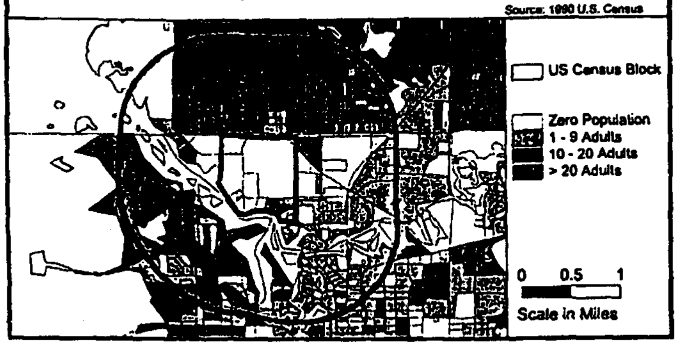
Children 6 Years and Younger

Source: 1990 U.S. Census



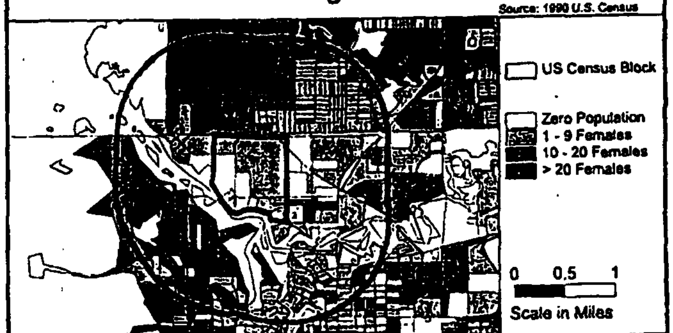
Adults 65 Years and Older

Source: 1990 U.S. Census



Females Aged 15 - 44

Source: 1990 U.S. Census



SAAGIS

JVA102388

COMMUNITY HEALTH CONCERNS

Residents from Tarpon Springs, and Holiday, Florida expressed concern about adverse health effects resulting from exposure to radium and heavy metals leaching from phosphate slag that was used in nearby roads and buildings. Besides radium, other contaminants of concern to residents were arsenic, beryllium, uranium, radium, radon, and ionizing radiation.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

A. Contamination

ATSDR reviewed the report of the radiological survey that EPA Region IV conducted during the week of August 23, 1998 (2). The gamma radiation surveys were taken at four off site residences near the Stauffer Chemical Superfund site in Tarpon Springs, Florida. Slag and soil samples were taken at 10 residences and chemically analyzed (3) to determine if there was a toxicological risk to the public and also to compare the contaminants in the off site slag to those at the Stauffer site. Slag appeared to be in a sintered form (i.e., trapped in a glass like matrix), consistent with an arc furnace extraction process. Samples were analyzed for aluminum, antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cobalt, copper, iron, manganese, mercury, nickel, radium, selenium, silver, thallium, vanadium, fluoride, and zinc.

ATSDR staff also reviewed relevant tests conducted by EPA representatives (2,3) and health-related reports issued by the Florida Department of Health (FDOH). The FDOH, through a cooperative agreement with ATSDR, has issued a public health assessment for the Stauffer site (4) and a health consultation for the Gulfside Elementary School in Holiday, Florida (5).

The Appendix contains the radiological survey and sampling data from the site visit (Stauffer Chemical Vicinity Properties) during the week of August 23, 1998.

Static gamma radiation surveys were taken in four residences using a pressurized ion chamber (PIC). This instrument is calibrated in microrad per hour (μrad/hr) and was provided and operated by the EPA's National Air, Radiation and Environmental Laboratory (NAREL). Comparison surveys were taken at the same locations with a Bicron Micro Rem meter, S/N B792W, calibration date of August 4, 1998. Measurements were taken at both waist level (normal standard for exposure surveys) and ground level for comparison purposes.

The hurricane proof construction style of residence #1 (see Table 1) is different than any other home encountered. The floors and some walls on both levels are poured concrete that use phosphate slag as aggregate. This resulted in the basement floor's having more than twice the gamma dose rate of the upstairs living space.

B. Quality Assurance and Quality Control

In preparing this public health assessment (PHA), ATSDR relied on the information provided in the referenced documents. The agency assumed that adequate quality assurance and quality control measures were followed with regard to chain-of-authority, laboratory procedures, and data reporting. The validity of the analyses and the conclusions drawn in this document was determined by the availability and reliability of the referenced information.

PATHWAYS ANALYSIS

At the time of the PHA, there was a completed exposure pathway from ionizing radiation. EPA samples of selected residences found that driveways, yard fill, home foundations, and other concrete structures contained phosphate slag with high concentrations of the natural radium isotope Ra-226 (3). Radiation dose measurements in several homes were elevated above background, but not sufficient to represent a health hazard. The normal background for the Tarpon Springs area was about 60 millirem per year (mrem/yr), excluding the contribution from radon. If the dose from radon for this part of Florida is included, the annual background dose is about 160 mrem/yr. Florida has a rather low background dose compared to Denver, Colorado, which is about 300 millirem (including the contribution to total dose from radon). The International Council on Radiation Protection (ICRP) recommends that radiation doses to the public not exceed 500 millirem in any 5 year period and should be less than 100 millirem per year over a lifetime. This excludes doses from background (i.e., natural sources), diagnostic (e.g., x-rays) and other medical exposures(6). The lowest observed adverse effect level (LOAEL) from ionizing radiation is from 10 to 25 rem in one exposure and is seen as a slight decrease in blood cell count (7).

Radon samples in homes were all below EPA's action level of 4 pCi/L, and did not find any radon gas coming from radium contaminated slag. The lack of radon would be expected from the glass-like character of the slag. The glass-like property of the slag would also impede leaching of heavy metals present.

Assuming a conservative occupancy factor of 17 hours per day to contaminated parts of the residence and an hour on contaminated driveway for 350 days per year, the annual radiation doses excluding background could be as high 210 millirem per year (mrem/yr) at residence #1 (see Table 1 in the appendix), and as low as 41 mrem/yr at residence #3 (see Table 3 in the appendix). No infants or elderly individuals, who would be expected to be home more than 17 hours per day, lived in the most contaminated homes. Using a conservative exposure model for a maximally exposed child in the most contaminated home, the expected annual dose was more than twice the ICRP's and National Council on Radiation Protection and Measurement's (NCRP) recommendation for exposures to the public (6,8).

PUBLIC HEALTH IMPLICATIONS

All the radium levels sampled at off site residences and the associated gamma radiation were elevated above background levels. The ICRP (6) and the NCRP (8) recommend limiting annual exposure to external radiation to 100 mrem/yr above background levels, excluding exposures from medical procedures. The LOAEL from ionizing radiation is from 10 to 50 rem in a short period of time (i.e. less than a week) and is seen as a slight decrease in blood cell count (7). (Note: A rem is equivalent to a rad for gamma radiation and one rem is equivalent to 1,000 millirem.)

Of the four homes sampled in the Tarpon Springs area, only one exceeded any recommended health limits of the ICRP and NCRP. Residence #1 had significantly elevated radiation levels, especially in the basement. Using a conservative scenario, the annual dose to someone living in a basement bedroom could receive about 210 mrem/yr above background. That is over twice the limit recommended by the ICRP and NCRP. No other homes tested approached the recommended limit of 100 mrem/yr.

The ICRP and NCRP recommendations are very conservative and are a factor of 100 below the LOAEL for acute exposure to ionizing radiation. Even though the total dose inclusive of background would be 250 mrem/yr, this is still below the national average background dose in the United States of 300 mrem/yr (9). No adverse health effects would be expected from residing in the most contaminated home.

Contaminated slag at sampled vicinity properties, does not appear to contain sufficient heavy metals to represent a public health hazard, based on current medical, epidemiological and toxicological information. For non-radioactive chemicals and metals, ATSDR uses comparison values (contaminant concentrations in specific media and for specific exposure routes believed to be without risk of adverse health effects) to select contaminants for further evaluation. ATSDR and other agencies have developed the values to provide guidelines for estimating media contaminant concentrations that are not likely to cause adverse health effects, given a standard daily ingestion rate and standard body weight. Table 5 lists environmental media exposure guidelines (EMEGs) and reference media exposure guidelines (RMEGs).

Many of these values have been derived from animal studies. Health effects are related not only to the exposure dose, but to the route of entry into the body and the amount of chemical absorbed by the body. Several comparison values might be available for a specific contaminant. To protect the most sensitive segment of the population, ATSDR generally selects the comparison value that uses the most conservative exposure assumptions.

Special Considerations of Women and Children

Radiation doses are calculated at ½ meter from the floor to better estimate the dose to children. Although there is a completed exposure pathway for ionizing radiation from radium-contaminated slag and aggregate, the dose to children is still below the national average background dose of 300 mrem per year and is not expected to result in any adverse health effects. Contaminated slag at sampled vicinity properties, does not appear to contain sufficient heavy metals to represent a health hazard to women or children, based on current medical, epidemiological and toxicological information.

Women and children may sometimes be affected differently from the general population by contaminants in environmental media. For one thing, they are smaller than the population average, and so are affected by smaller quantities of the contaminants. The effect of hormonal variations, pregnancy, and lactation can also change the way a woman's body responds to some substances. Exposure during pregnancy and lactation can expose the woman's fetus or infant to the substances if they cross her placenta or get into her milk. Depending on the stage of her pregnancy, exposure of her fetus could result in its death (miscarriage or stillbirth) or impaired development (birth defects). If she is exposed during lactation, her milk may concentrate certain contaminants, increasing the exposure of her infant above that of her own.

ATSDR's Child Health Initiative recognizes that unique vulnerabilities are inherent in the developing young, whether fetus, infant, or child. Public health assessments need to include evaluations of potential effects on the young in light of these unique parameters. For example, children are not just "small adults." Children are smaller, and so some exposures would affect them more because of their reduced body weight and higher ingestion rate, resulting in an increased dose or amount taken into the body compared to the body weight. A child's shorter height results in higher gamma radiation dose from contaminated concrete floors and the need to base dose estimates at half a meter rather than one meter.

In addition to physical and behavioral differences, the young have heightened susceptibility stemming from other causes.

Children's metabolic pathways, especially in the first months after birth, are less developed than those of adults. While in some instances children are better able to deal with environmental toxins, in others, they are less able and are thus more vulnerable. Some chemicals that are not toxins to adults are highly toxic to infants.

Children are undergoing rapid growth and development in the first months and years of life. Some organs systems, especially the nervous and respiratory systems, may experience permanent dysfunction if exposed to high concentrations of certain contaminants during this period. In addition, because of the more rapid growth and development, a child's DNA is more likely to be exposed than later in life, rendering this period of life more vulnerable to genotoxic insult.

Children have more future years than adults, so exposure during early years leaves more time for development of chronic diseases. This would be especially true in the case of multistage diseases (e.g., cancer) which may require many years to progress from earliest initiation to actual manifestation of illness.

Finally, children have less ability to avoid hazards in that they are dependent on adults for decisions which may have effects on children but not adults. Adults may not recognize circumstances hazardous to children, especially those not hazardous to adults.

CONCLUSIONS

1. Contaminated slag from the Stauffer Chemical Superfund site, reportedly has been used as concrete aggregate in homes, roads and roadbeds in the Tarpon Springs and Holiday, Florida vicinity.

2. Because of the special hurricane resistant poured concrete and steel I-beam construction of residence #1, the levels of ionizing gamma radiation at that residence exceed, national and international recommendations for exposure of members of the public from ionizing radiation by more than a factor of two.

3. Although there is a completed exposure pathway for ionizing radiation from radium-contaminated slag and aggregate, the doses residents are exposed to is still below the national average background dose of 300 mrem per year. Adverse health effects would not be expected until background levels are exceeded by 10 rem above background.

4. Contaminated slag at sampled vicinity properties, does not appear to contain sufficient heavy metals to represent a public health hazard, based on current medical, epidemiological and toxicological information.

5. Combined exposures from contaminated driveways and roads are not a health threat.

RECOMMENDATIONS

1. ATSDR recommends that public health education be provided to help the public better understand that there is currently no general public health hazard posed by the phosphate slag and to provide information to community members on the environmental health effects presented in the Stauffer Chemical Vicinity Properties public health assessment addendum.

2. Even though estimated doses to those living in residence #1 are below the national average dose to the public from background, they can minimize their potential health risk by limiting the time spent in the basement and not have sleeping quarters on the basement level until contamination is mitigated.

PUBLIC HEALTH ACTION PLAN

The public health action plan for the Stauffer Chemical Vicinity Properties contains a description of actions to be taken by the Agency for Toxic Substances and Disease Registry (ATSDR) and other government agencies at and in the vicinity of the site after the completion of this public health assessment. The purpose of this Public Health Action Plan is to ensure that this public health assessment not only identifies public health hazards but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment.

Upon request from the public, the Florida Department of Health (FDOH) will develop and implement an environmental health education program to help community members understand the potential for past exposure and to provide information on assessing any adverse health occurrences that might be related to phosphate slag.

PREPARER OF REPORT

Author

Michael D. Brooks, CHP
Health Physicist
Federal Facilities Assessment Branch
Division of Health Assessment and Consultation
ATSDR

REFERENCES

1. Bureau of the Census, U.S. Department of Commerce, Washington, DC, 1990 Census *Data Files.*

2. Memorandum dated September 2, 1998, from Rick Button, Health Physicist to John Blanchard, Remedial Project Manager, US EPA. Report on radiological surveys conducted and observations for the offsite Stauffer Chemical visit of August, 1998 in Tarpon Springs, FL.

3. Memorandum dated September 17, 1998, from John Griggs, Chief Monitoring and Analytical Services Branch to John Blanchard, US EPA Region IV, Waste Division. Radiochemical results for Tarpon Springs Samples.

4. Florida Department of Health. Preliminary Public Health Assessment for Stauffer Chemical Company/Tarpon Springs, Tarpon Springs, Pinellas County, Florida. FDOH: Tallahassee, August 4, 1993.

5. Florida Department of Health, Bureau of Environmental Toxicology, Under Cooperative Agreement with the Agency for Toxic Substances and Disease Registry, Health Consultation for the Gulfside Elementary School, Holiday, Florida dated June 18, 1998.

6. ICRP (1990). International Commission on Radiological Protection (ICRP) Recommendations of the International Commission on Radiological Protection. ICRP Publication 60. New York: Pergamon Press. 1990.

7. National Council on Radiation Protection and Measurements. Influence of Dose and Its Distribution in Time on Dose-Response Relationships for Low-LET Radiations, NCRP Report No. 64. NCRP: Bethesda, 1980.

8. National Council on Radiation Protection and Measurements. Limitation of Exposure to Ionizing Radiation, NCRP Report No. 116. NCRP: Bethesda, March 31, 1993.

9. National Council on Radiation Protection and Measurements. Exposure of the Population in the United States and Canada from Natural Background Radiation, NCRP Report No. 94. NCRP: Bethesda, December 30, 1987.

Appendix

The observed radiation background for similar residences was 6-7 microrad per hour (μrad/hr). Average dose rates in affected areas ranged from 15.4 to 39.1 μrad/hr, including background (or 10 to 33 μrad/hr above background). One rad is equivalent to one rem for gamma radiation. The recommended average annual dose limit to members of the public from ionizing radiation is 100 millirem per year, per the International Commission on Radiation Protection (ICRP) (6).

Table 1 Stauffer Chemical Vicinity Properties - Residence 1

Location	Residence 1	μr/hr (waist level)	μr/hr ground level	Average
#1	basement	42	49	45
#2	basement	38	44	41
#3	basement	43	48	46
#4	basement	47	51	49
#5	basement	44	51	47
#6	basement	31	41	36
#7	basement	45	46	45
#8	basement	30	44	37
#9	basement	46	53	49
#10	basement	42	48	45
#11	bedroom	31	41	36
#12	bedroom	30	39	35
#13	1st floor	14	17	16
#14	1st floor	20	28	24
#15	1st floor	10	9	10
#16	1st floor	19	26	22
#17	1st floor	26	29	27
#18	1st floor	25	31	28
#19	1st floor	11	12	11
#20	1st floor	9	11	10
#21	driveway	29	38	34
#22	driveway	29	39	34
#23	driveway	60	73	67
Average	living areas	16.7 (1st floor)		
Annual Dose (mrem)				210

Note: One rad is equivalent to one rem for gamma radiation. One thousand microrad (μrad) are equivalent to one millirad (mrad).

To calculate an Annual Dose, because there were small children in the home, took an average of the one meter and ground level measurements, then subtracted background=6 μrad/hr and assumed 12 hours per day in the bedroom, 5 hours in the basement, 1 hour on the first floor and an hour on the driveway for 350 days per year.

Table 2 Stauffer Chemical Vicinity Properties - Residence 2

Location:	Residence 2	µrad/hr (waist level)	µrad/hr (ground level)
#1	bedroom	20	n/a
#2	bedroom	21	n/a
#3	bedroom	20	n/a
#4	bedroom	22	n/a
#5	bedroom	26	n/a
#6	bedroom	27	n/a
#7	bedroom	28	n/a
#8	bedroom	21	n/a
#9	bedroom	25	n/a
#10	bedroom	27	n/a
#11	bedroom	29	n/a
#12	bedroom	27	n/a
#13	bedroom	21	n/a
Annual Dose		76 (mrem)	n/a

Note: One rad is equivalent to one rem for gamma radiation. One thousand microrad (µrad) are equivalent to one millirad (mrad). To calculate an Annual Dose, subtracted background=6 µrad/hr and assumed 12 hours per day in the bedroom and 5 hours in other parts of the house for 350 days per year.

Table 3 Stauffer Chemical Vicinity Properties - Residence 3

Location:	Residence 3	µrad/hr (waist level)	µrad/hr (ground level)
#1	o/s slab	25	n/a
#2	o/s slab	25	36
#3	o/s slab	19	n/a
#4	o/s slab	19	34
#5	o/s slab	22	n/a
#6	o/s slab	29	36
#7	o/s slab	22	n/a
#8	o/s slab	23	n/a
#9	living room	22	21
#10	living room	19	23
#11	living room	19	26
#12	living room	20	26
#13	kitchen	20	22
#14	kitchen	19	26
#15	bathroom	15	16
#16	o/s bathroom	15	16
#17	side bedroom	8	9
#18	back left bedroom	7	6
#19	back right bedroom	15	13
#20	back right bed	7	6
Annual Dose		41 (mrem)	

Note: One rad is equivalent to one rem for gamma radiation. One thousand microrad (µrad) are equivalent to one millirad (mrad). To calculate an Annual Dose, subtracted background=6 µrad/hr and assumed 12 hours per day in the bedroom, 5 hours in other areas of the house and 1 hour on the outside slab for 350 days per year.

Table 4 Stauffer Chemical Vicinity Properties - Residence 4

Location:	Residence 4	µrad/hr (waist level)	µrad/hr (ground level)
#1	garage	21.5	36.1
#2	garage	25.7	37.1
#3	garage	21.7	25.7
#4	garage	21.5	35.7
#5	foyer	10.2	n/a
#6	foyer	9.4	n/a
#7	foyer (by door)	13.0	n/a
#8	adjacent bath	12.1	n/a
#9	adjacent bath	9.8	n/a
#10	back door	11.4	n/a
Annual Dose		50 (mrem)	

Note: One rad is equivalent to one rem for gamma radiation. One thousand microrad (µrad) are equivalent to one millirad (mrad). To calculate an Annual Dose, subtracted background=6 µrad/hr and assumed 12 hours per day in the house and 5 hours in the garage for 350 days per year.

Table 5 Maximum Contaminant Concentrations in Parts per Million (ppm)

Contaminant	Driveway Pavement	Driveway Base	Yard Soil	Comparison Value
Antimony	0.0566	0.252	0.0469	20 (Chronic RMEG Child)
Arsenic	4.85	3.84	0.829	20 (Chronic RMEG Child)
Beryllium	1.24	1.92	0.749	100 (Chronic RMEG Child)
Chromium	27.7	22.3	49.6	200 (Chronic RMEG Child)
Lead	18.2	11.7	31.8	None
Thallium	0.70	0.614	0.0658	5 (Chronic RMEG Child)
Vanadium	33.9	26.3	17.2	200 (Intermediate EMEG Child)
Radium-226	70.2 (pCi/g)	6.21 (pCi/g)	25.1 (pCi/g)	5 pCi/g to 5 cm depth 15 pCi/g below 5 cm (40 CFR 192)

Key: Reference Media Exposure Guideline (RMEG)
Environmental Media Exposure Guideline (EMEG)
EPA Standards for Uranium and Thorium Mill Tailings {40 CFR 192 (1983)}
Code of Federal Regulations (CFR)

Georgia Fiscal Year 99 Workplan October - December 1998							
SITE NAME/ CERCLIS #	PUBLIC HEALTH ACTIVITIES/OUTPUTS					IMPACT/ OUTCOMES	COMMENTS
	HEALTH EVALUATIONS	COMMUNITY INVOLVEMENT	HEALTH EDUCATION	TECHNICAL ASSISTS	HEALTH STUDIES		
Atlanta Gas Light Waycross, GA (DHR request)	CHI: Work with advisory panel to investigate exposures at site. Meeting 11/98	STM: 11/98	TRP,MTD,MTV: Georgia Hazardous Waste Sites Partnering Workshop 10/98	WPL:Review workplan put together by advisory commitee		Assist District Health Department in evaluating exposure at this site. Provide a platform for inter-agency communication at hazardous waste sites.	
Atlantic Steel				ING ODR SUM:12/18/98		Appointed member of Stakeholder's Panel. Will serve as public health advisor to site re-development.	

Barnesville-Goggins Road MSWL Lamar County (EPD request)	SIV: Site visit to determine if HC is appropriate 2/99 HCW: if appropriate, 6/99					Health Consultation to address potential for exposure to off-site contamination released from landfill.	
<u>Brownfields Program Development (ATSDR request)</u>		**CAP**: Form and quarterly meetings for statewide representation 1 - 10/99.	**BK**: Booklet on brownfields 8/99. **AV**: Develop website for national information clearinghouse with GA Tech Research Institute 1 - 10/99. <u>Grant Proposal for EPA Env. Ed. Grant FY99: 11/7/98</u>			Outcome: Establish state resource panel for community involvement and education. Outcome: provide info source for all potential sites. Outcome: provide public health consultation resource for brownfields PH issues. <u>Requested funds for TT for ATSDR/NACCHO Needs</u> Assessment tool.	

Burke County Landfill Clarke Place Road Waynesboro, Burke County, GA 30803 (EPD request)	**HCW:** Completion dependant upon GA EPD and County consultant activity.			**SPL:** Review of any new data from County consultant.		Health Consultation to address potential for exposure to off-site contamination released from landfill.	Awaiting future data.
Camilla Escambia Wood Preserving Site 131 E. Bennett Street Camilla, Mitchell County, GA 31730 GAD008212409 (ATSDR request)	**PHR:** Public Health Assessment to be co-authored with ATSDR. Completion date by 4/99. **CHI:** research of cancer registry.	**PMC:** Public meeting upon completion of PHA 5/99. STM: Team meeting with ATSDR 11/99.	**LE:** Georgia Hazardous Waste Workshop 10/98. MTV, TRP, MTD: Georgia Hazardous Waste Site Workshop 10/98	**ODR:** Review of data from EPA (off-site soil) 10/98.		Public Health Assessment to address all relevant public health issues at Superfund site. Frequent data review.	
Dikes Creek Area Rome, GA Floyd County (Community request)			SV: Site visit to investigate area for possible hazardous waste contamination 12/16/98				

Dunlap Road PH I MSWL, Clarke County (EPD request)	**HCW:** Projected 3/99. **SIV:** Site visit to investigate area and interview residents 12/99.	**CIC:** Interviews with residents during site visits. Also public officials.		**SPL:** Review of scheduled off-site sampling efforts.		Health Consultation to address potential for exposure to off-site contamination released from landfill.	
Environ-mentalist Training (DHR request)			**TT:** Train district and local environ-mentalists in haz. waste issues 3 - 12/99. **LE:** Short course for environ-mentalists on toxicology related issues 10/98 and 4/99.			Increased knowledge in the human health effects of hazardous waste. Increased knowledge in communicating risk to impacted communities.	

General Electric Company Rome, GA Floyd County (DHR/Community /Local Government request)	IG: Gathered site information from local library 9/19/98 SIV: Site visit to determine if HC is appropriate 10/1/98 IG: Gathered site information from EPD 11/4/98		DM: American Cancer Society Facts & Figures 11/5/98 DM: ATSDR Fact Sheet on PCB's 10/20/98	LTR: Letter to City Manager regarding cancer concerns and data requests 11/5/98			
Hargis Rail Fleet Services GA EPD HSI Site 10368 Gordon Wilkinson County	SIV: Site investigation to address public health questions					Assure concerned residents that contaminated soils stockpile is not a threat to public health	
Hercules 009 Landfill - Brunswick (ATSDR request)	EIP: Investigation of site to answer public health questions 12/98		IG: Provide information for TechLaw,Inc. rearchers 12/6/98 ODR: Provide information for Site Information Sheet 12/9/98-			Answer specific health questions about site for ATSDR/EPA	

Housers Mill Road MSWLF Peach County (Peach Co. Commission request)				TA: Wrote letter to County Commission regarding ATSDR's recommendation not to use contaminated water wells by adjacent property owners.		Outcome: reinforce to the property owners that using ground water wells and connecting hoses to the wells may promote the use of the well water as a drinking water source by the residents during outside activity.	
Jefferson County - Avera Road MSWL Louisville, GA (EPD request)	**HCW:** completed 10/98			**SPL:** Review of any new data from County consultant.		Health Consultation to address potential for exposure to off-site contamination released from landfill.	
Seminole Rd. Landfill, Dekalb Co. (DHR request)	**HCW:** 11/98		**TT:** 11/98	**SPL:** Review of new data from NMOCs.		Community has increased understanding of the health effects of landfill gas and leachate.	

Marble Top Road MSWL Walker County (EPD/ATSDR request)	SIV: Site Visit to determine whether HC is appropriate 12/98 HCW: If appropriate, 3/99 IG: Gathered site information from local EH office and library 9/15/98			SVR: Met and observed consultants performing routine well water sampling 9/14/98		Health Consultation to address potential for exposure to off-site contamination released from landfill.	
Marzone - Tifton (EPA request)	SIV: 12/98 Join EPA for a site visit	PMC: Public Meeting 12/98		ROD: 11/98		Assist EPA in presenting ROD to public at meeting.	
Paulding County MSWL (EPD Request)	HCO: 12/22/98 HCW: planned completion 1/31/98 EIB: sampling of well for coliform EIE: appendix I sampling of private well	CIC: interviewed affected resident		ODR VTA: assisted EPD in health related matters.		Provided technical assistance to EPD to identify and treat a coliform and potential chemical contamination of a private well	**Health consultation will be completed pending final sampling data.**

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

July 5, 2002

SITE: STAUFFER (TARPON)
BREAK: 3.11
OTHER: v.31

Mr. Nestor Young
U. S. Environmental Protection Agency, Region IV
61 Forsyth Street, SW
Atlanta, GA 30303-8960

Dear Mr. Young:

Enclosed please find a copy of the health consultation for the health consultation for Stauffer Chemical Company Superfund Site and Vicinity Properties [a/k/a Stauffer Chemical Company (Tarpon Springs)], Tarpon Springs, Pinellas County, Florida, dated July 1, 2002. This health consultation addresses the residents' concern about possible adverse health effects resulting from exposure to gamma radiation from phosphorus slag that was used in nearby roads, buildings, and homes.

Please address correspondence to the Chief, Program Evaluation, Records, and Information Services Branch, Division of Health Assessment and Consultation, Agency for Toxic Substances and Disease Registry, ATTN: Stauffer Chemical Company Superfund Site and Vicinity Properties, 1600 Clifton Road, NE (E56), Atlanta, Georgia 30333.

If there are any questions, please direct them to Michael Brooks, the health assessor, at (404) 498-0360.

Sincerely yours,

Max M. Howie, Jr.
Chief, Program Evaluation, Records,
and Information Services Branch
Division of Health Assessment
and Consultation

Enclosure

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR or
Visit our Home Page at: http://www.atsdr.cdc.gov

10462823

Health Consultation

Evaluating Dose Measurements of Gamma Radiation
for Residents near the Stauffer Chemical Company

STAUFFER CHEMICAL COMPANY SUPERFUND SITE AND
VICINITY PROPERTIES
[a/k/a STAUFFER CHEMICAL COMPANY (TARPON SPRINGS)]

TARPON SPRINGS, PINELLAS COUNTY, FLORIDA

EPA FACILITY ID: FLD010596013

JULY 1, 2002

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members.

This document has previously been released for a 30 day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The health consultation has now been reissued. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

HEALTH CONSULTATION

Evaluating Dose Measurements of Gamma Radiation
for Residents near the Stauffer Chemical Company

STAUFFER CHEMICAL COMPANY SUPERFUND SITE AND VICINITY PROPERTIES
[a/k/a STAUFFER CHEMICAL COMPANY (TARPON SPRINGS)]

TARPON SPRINGS, PINELLAS COUNTY, FLORIDA

EPA FACILITY ID: FLD010596013

Prepared by:

Energy Section
Federal Facilities Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Summary

From 1947 to 1981, the Stauffer Chemical Company in Tarpon Springs, Florida, made elemental phosphorus from phosphate ore. While the plant was in operation, phosphorus slag was transported off the site and used as aggregate in road bedding, road and driveway paving, and in concrete structures. Residents in the area are concerned about possible adverse health effects resulting from exposure to gamma radiation from phosphorus slag that was used in nearby roads, buildings, and homes. Gamma radiation, or gamma rays, consists of bundles of electromagnetic energy and is the same type of radiation as medical x-rays.

In 1999, at their request, residents of the community surrounding the former Stauffer chemical plant were given thermoluminescent dosimeters (TLDs) by the Pinellas County Health Department to monitor their individual gamma radiation dose measurements for a 30-day period. As a follow-up to the previous public health assessment addendum for the site issued in June 1999 and to a draft public health response plan for the site released in June 2001, the Agency for Toxic Substances and Disease Registry (ATSDR) reviewed the individual dose measurements recorded by the Pinellas County Health Department for the 60 participants of this Tarpon Springs, Florida, community.

The exposure investigation was field research of a descriptive nature and was not designed or conducted as an inferential investigation. No generalizations should be drawn from it. The sample consisted of individuals from southwest Pasco County and northern Pinellas County and contained every person who volunteered. Originally, it was anticipated that there would be a large number of volunteers and that a sample of those volunteers would be chosen to wear the dosimeter badges. Because there were only as many volunteers as there were badges, the entire sample was self-selected.

Background, or naturally occurring radiation, varies by location in the United States and is measured in one-thousandth of rem, or millirem (mrem). Background radiation comes from cosmic sources, naturally occurring radioactive materials (e.g., radium in phosphate ore), the food and water we consume and global fallout as it exists in the environment from nuclear weapons testing. Background gamma radiation dose rates for the United States average anywhere from 44 to 133 mrem per year. The average dose to 57 of the 60 monitored in Pinellas and Pasco counties was 92 mrem per year, although it was not possible to quantify the contribution from slag for all participants.

Two participants lost their dosimeters and were therefore not included. One participant had an elevated dose of 166 mrem per year, and on a follow-up measurement by ATSDR, was found to have an area of pure phosphorus slag poured on the soil foundation under her home. The dose of 166 mrem per year was confirmed and elevated, but does not represent any health threat to the resident.

Another participant had a single monthly dose of 41.1 mrem, which would equate to a dose rate of 529 mrem per year. ATSDR made follow-up measurements of the participant's home, yard and office, and was unable to locate the source of the elevated exposure. This participant's dose

was excluded from the calculation of the average, median and standard deviation, because ATSDR could not confirm the source of the dose with environmental monitoring. Though the measured exposure could not be confirmed by environmental measurements, ATSDR used the high level to estimate the annual rate, which was determined not to be a health threat.

The measurements of the remaining 57 participants show that the combined gamma radiation doses measured by TLDs are not elevated and do not pose a health threat to participants.

Background and Statement of Issues

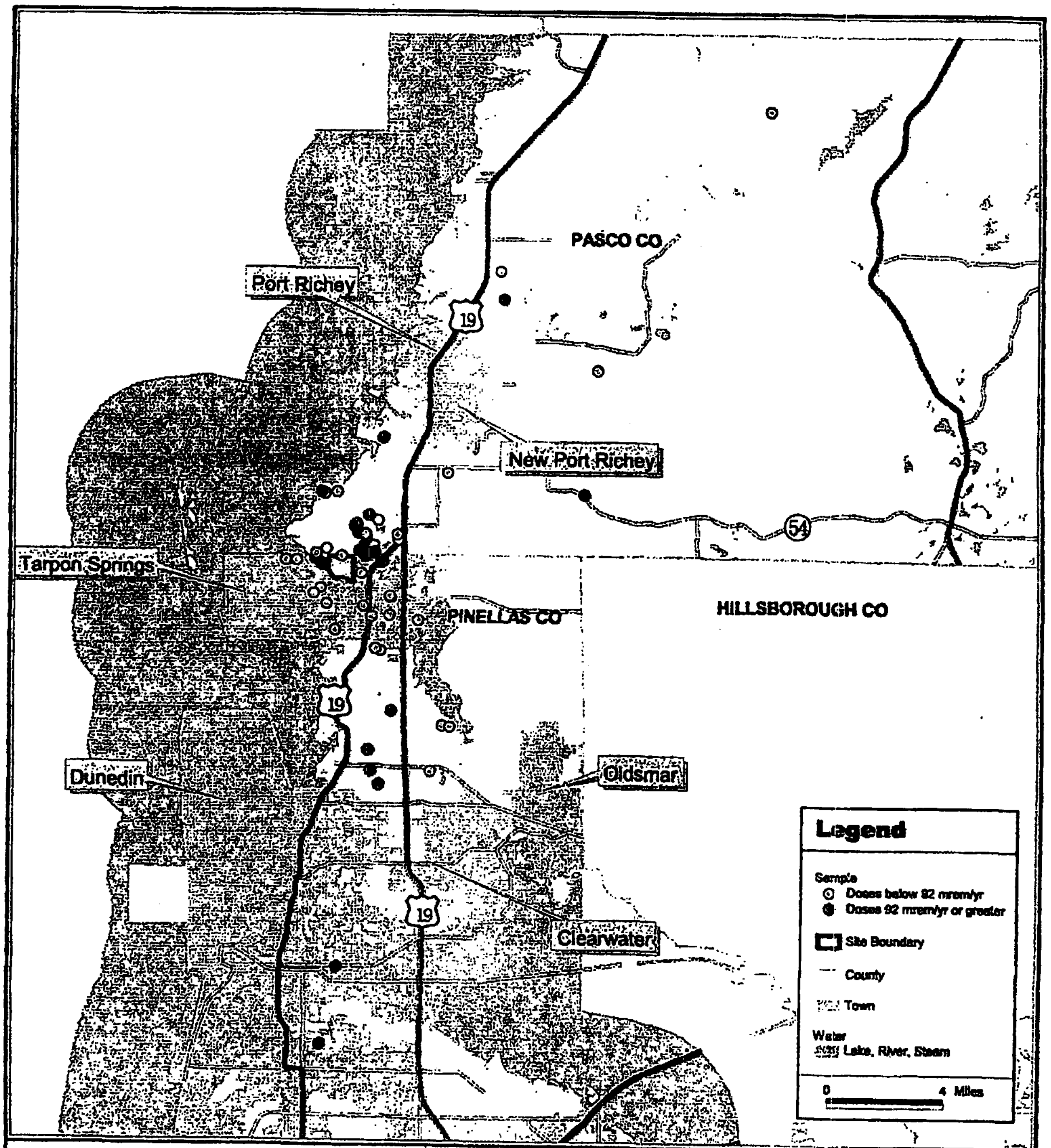
The Pinellas County Health Department, responding to public request, provided thermoluminescent dosimeters (TLDs) to persons who wanted their radiation dose measured and who lived near the former Stauffer chemical plant in Tarpon Springs, Florida. The Agency for Toxic Substances and Disease Registry (ATSDR) evaluated the gamma radiation doses measured by the Pinellas County Health Department for residents near the site who had requested TLDs. This ATSDR evaluation is a follow-up action to the previous Public Health Assessment Addendum[1] on phosphorus slag for the Stauffer Chemical Company site and Vicinity Properties in Tarpon Springs and Holiday, Florida, which was issued in June 1999, and to a draft public health response plan for the site released in 2001.

ATSDR has previously reviewed sampling and survey data collected by the Florida Department of Public Health[2] and the Environmental Protection Agency Region IV[3], as well as the previous public health assessment that was performed by the Florida Department of Public Health under a cooperative agreement with ATSDR[4].

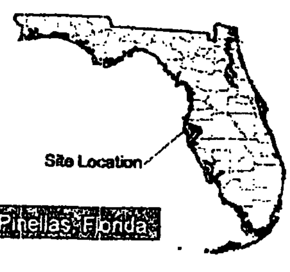
The exposure investigation was field research of a descriptive nature and was not designed or conducted as an inferential investigation. No generalizations should be drawn from it. The sample consisted of individuals from southwest Pasco County and northern Pinellas County and contained every person who volunteered. Originally, it was anticipated that there would be a large number of volunteers and that a sample of those volunteers would be chosen to wear the dosimeter badges. Because there were only as many volunteers as there were badges, the entire sample was self-selected. In addition there are several studies that have looked at radiation from the phosphorus slag from the Stauffer site. The ATSDR Public Health Assessment Addendum[1] on phosphorus slag is heavily based on the January 1999 EPA report. This evaluation only looks at radiation doses measured by the Pinellas County Health Department, measured in late Fall 1999.

TLDs are made of crystalline material (solid state) that emits light in proportion to the ionizing radiation absorbed, when the device is heated.

Dose measurements performed at the residents' request were purely voluntary. TLDs were distributed to residents of the communities surrounding the former plant, regardless of whether they had phosphorus slag on their property. The Vicinity Map shows the locations of the study participants. These residents were asked to wear the TLDs all day for a 30-day period, but not during medical procedures (e.g., x-rays) or expose them to known radioactive sources. ATSDR assumed that the participants were compliant with given instructions. Measurements were extrapolated, or projected, to yearly doses. The measurements were taken during the last few months of 1999[5]. For the purpose of this consultation, ATSDR will assume that all homes potentially contained some slag, because the use of phosphorus slag and phosphorus ore as aggregate is widespread in this part of Florida, and most people are, to some degree, exposed to gamma radiation from the slag or ore. A table of measured doses for this exposure assessment is located at the end of this consultation.



Participant locations for Pinellas/Pasco TLD assessment



VICINITY MAP

Pinellas, Florida

Discussion

The average dose rate to 57 of the 60 participants was 92 mrem per year. Two participants (#40 & #50) lost their badges and therefore did not receive a dose measurement. Participant #38 had a 30 day dose of 44.1 mrem, which equates to an annual dose rate of 529 mrem per year. ATSDR made follow-up measurements of the participant's home, yard and office, and was unable to locate the source of the elevated exposure[6].

Participant #38's dose was also excluded from the calculation of the average, median and standard deviation. The elevated exposure could have been the result of visiting a patient at a medical establishment where nuclear medical treatment and diagnostic procedures are performed, visiting someone who had a nuclear medical procedure (e.g., I-131 thyroid ablation, thallium stress test, bone scan, etc.) or from having a diagnostic nuclear medical procedure.

One additional subject (#49) included in the calculations, measured 166 mrem per year, which was well above the average for this assessment and above the range of average for the United States. Average background doses from terrestrial and cosmic gamma radiation for cities in the United States range from 44 to 133 mrem per year[7] and for this exposure assessment was 92 mrem per year. The doses in cities have been measured with environmental TLDs for more than thirty years. The doses are reported as averages within a city and do not represent the range of doses within each city. Because, participant #49's dose was well above the typical background in the US and well above the average dose in the exposure investigation, ATSDR surveyed the home and found an area of pure slag poured over its soil foundation. (Note: Phosphorous slag is a basaltic byproduct material that was commonly crushed and used in Florida as concrete aggregate. Pure slag refers to the use of slag in its raw undiluted form.)

Survey measurements of subject #49's home were consistent with the measured dose. The survey instrument used was a Ludlum MicroR Meter Model 19, serial # 77635, calibrated on Oct. 3, 2001. The Patio where the participant spent more than 50% of her time, measured 44 µR/hr at one meter. This would result in an annual dose rate of 150 mrem/yr, when corrected for radium. This is consistent with the TLD measured annual dose rate of 166 mrem/year which includes all sources including background.

Figure 2, shows the distribution of doses in the study versus the number of participants at that dose. The graph excludes those who lost their TLDs.

ATSDR's Minimum Risk Level[8] (MRL) for ionizing radiation is 100 millirem per year above background. The MRL is an estimate of human exposure-by a specified route and length of time-to a dose of chemical or other agent that is likely to be without measurable risk of adverse, non-cancerous effects. An MRL should not be used as a predictor of adverse health effects. (Note: background includes the dose from building materials). To put this in perspective, normal background from terrestrial, cosmic and internal gamma emitters average 100 mrem/yr. A common chest x-ray will give an effective dose of 60 mrem in a fraction of a second. A full abdominal CT scan will give an effective dose of 1,000 mrem in several minutes. Neither of these diagnostic medical procedures is believed to cause adverse health effects[9].

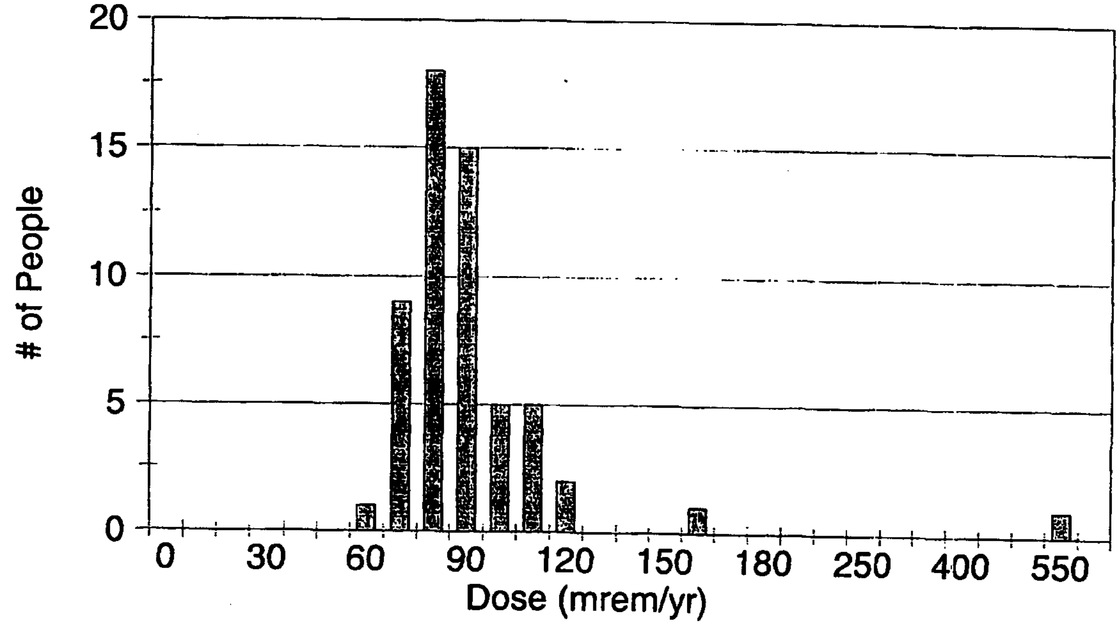


Figure 2 Annual Gamma Doses to Study Participants

The average annual effective dose in the United States population from natural background radiation is 300 millirem per year (mrem/yr). Radon and its decay products account for roughly 200 mrem/yr. Cosmic radiation contributes 26 mrem/yr at sea-level and greater than 50 mrem/yr in Denver. Terrestrial gamma radiation from the earth and building material contributes an average of 28 mrem/yr, but in certain areas with uranium or phosphate ore bodies and coastal areas with deposits of monazite sands, the contribution can be as high as 2000 mrem/yr. The contribution from internal radioactive materials, such as potassium-40 and polonium-210, is about 39 mrem/yr[10].

The Health Physics Society, the leading professional organization of radiation protection professionals, in its position statement "Radiation Risk In Perspective", states that "radiogenic health effects have not been observed below 10 rem" (10,000 mrem)[11]. It goes on to say:

"Radiogenic health effects (primarily cancer) are observed in humans only at doses in excess of 10 rem delivered at high dose rates. Below this dose, estimation of adverse health effect is speculative. Risk estimates that are used to predict health effects in exposed individuals or populations are based on epidemiological studies of well-defined populations (e.g., the Japanese survivors of the atomic bombings in 1945 and medical patients) exposed to relatively high doses delivered at high dose rate. Epidemiological studies have not demonstrated adverse health effects in individuals exposed to small doses (less than 10 rem) delivered in a period of many years."

Conclusions

1. The combined gamma radiation doses, as measured by TLDs, for the participants near the former Stauffer chemical plant do not pose a health threat to the participants in this exposure assessment and are consistent with background, with one exception.(see conclusion #2)

2. The individual (#49) that received 166 mrem dose is outside the normal range of background for Tarpon Springs, Florida, although not of sufficient magnitude to warrant concern from a health standpoint.

3. Participant #38's dose measurement was not confirmed. ATSDR made follow-up measurements of the participant's home, yard and office, and was unable to locate the source of the elevated exposure. Even if this dose was received every month, it would not result in a threat to the individual's health.

Public Health Actions Taken

1. ATSDR performed a follow-up radiation survey at the location where the 166 mrem level was observed and found that it was due to pure phosphorus slag poured over a soil foundation underlying the porch and livingroom. If the current resident is concerned about their dose, they can minimize their time spent in the livingroom and on the porch, or have the slag removed from the foundation.

2. ASTDR also performed a follow-up survey at the home, yard and office of subject #38, and there were no elevated dose readings at any location.

Prepared by:

Michael D. Brooks, CHP
Health Physicist

Table 1. Measurement Data

Subject #	City	Zip Code	Gamma Dose (mrem/yr)
1	Palm Harbor	34684	82
2	Tarpon Springs	34689	78
3	New Port Ritchie	34655	95
4	Tarpon Springs	34689	84
5	Holiday	34691	88
6	Tarpon Springs	34689	86
7	Tarpon Springs	34689	90
8	Holiday	34691	100
9	Palm Harbor	34683	113
10	Holiday	34691	62
11	New Port Ritchie	34652	110
12	Tarpon Springs	34689	88
13	Tarpon Springs	34689	122
14	Tarpon Springs	34689	89
15	Tarpon Springs	34689	76
16	Holiday	34691	94
17	Holiday	34691	101
18	Holiday	34691	83
19	Holiday	34691	88
20	Holiday	34691	94
21	Palm Harbor	34684	88
22	Holiday	34691	102
23	Holiday	34691	91
24	Holiday	34691	84
25	Holiday	34691	90
26	Palm Harbor	34683	97
27	New Port Ritchie	34652	90
28	Tarpon Springs	34689	116
29	Holiday	34691	86
30	New Port Ritchie	34654	91
31	Holiday	34691	112
32	Port Ritchie	34668	82
33	Palm Harbor	34683	100
34	Holiday	34691	85
35	Holiday	34691	80
36	Holiday	34691	79
37	Clearwater	33755	95
38	Tarpon Springs	34689	529*
39	Holiday	34691	85
40	Tarpon Springs	34689	lost
41	Tarpon Springs	34689	79
42	Tarpon Springs	34689	90
43	Holiday	34691	103
44	Palm Harbor	34684	79
45	Holiday	34691	72
46	Holiday	34691	85
47	Holiday	34691	73
48	Holiday	34691	94
49	Tarpon Springs	34689	166
50	Tarpon Springs	34689	lost

Subject #	City	Zip Code	Gamma Dose (mrem/yr)
51	Holiday	34691	70
52	Tarpon Springs	34689	83
53	Shady Hills	34610	83
54	Tarpon Springs	34689	95
55	Tarpon Springs	34689	86
56	Holiday	34691	116
57	Tarpon Springs	34689	73
58	Palm Harbor	34683	120
59	Tarpon Springs	34689	91
60	Port Ritchie	34668	95
	Median		**89**
	Standard Deviation		**16**

* included in calculations, because #38 received non-environmental exposures

References

1. ATSDR Public Health Assessment Addendum for the Stauffer Chemical Superfund Site Vicinity Properties, Tarpon Springs and Holiday, Florida, CERCLIS # FLD010596013, June 1999. Attention: Chief, Program Evaluation, Records, and Information Services Branch, ATSDR, 1600 Clifton Rd. (E56), Atlanta, GA 30333.

2. Memorandum dated September 2, 1998, from Rick Button, Health Physicist to John Blanchard, Remedial Project Manager, US EPA. Report on radiological surveys conducted and observations for the offsite Stauffer Chemical visit of August, 1998 in Tarpon Springs, FL.

3. Memorandum dated September 17, 1998, from John Griggs, Chief Monitoring and Analytical Services Branch to John Blanchard, US EPA Region IV, Waste Division. Radiochemical results for Tarpon Springs Samples.

4. Florida Department of Health. Preliminary Public Health Assessment for Stauffer Chemical Company/Tarpon Springs, Tarpon Springs, Pinellas County, Florida. FDOH: Tallahassee, August 4, 1993.

5. Pinellas-Pasco Regional Radiation Study, Pinellas County Health Department. Prepared by D. Michael Flanery, Feb. 4, 2000.

6. PCI Findings/Recommendations Concerning Tarpon Springs Superfund Site; PCI TR-466; Prepared by Sydney W. Porter, CHP; Feb. 6, 2002.

7. Eisenbud M, Gesell T. Environmental radioactivity from natural, industrial, and military sources. 4th ed. San Diego (CA): Academic Press; p. 183, 1997.

8. ATSDR Toxicological Profile for Ionizing Radiation, ATSDR, Atlanta, GA 30333, September 1999.

9. Wall BF, Hart D. Revised radiation doses for typical x-ray examinations. The British Journal of Radiology 70: 437-439; 1997

10. National Council on Radiation Protection and Measurements. Exposure of the Population in the United States and Canada from Natural Background Radiation, NCRP Report No. 94. NCRP: Bethesda, December 30, 1987.

11. Radiation Risk in Perspective, Position Paper of the Health Physics Society, McLean, VA 2001.

PUBLIC HEALTH ASSESSMENT ADDENDUM

Stauffer Chemical Superfund Site Vicinity Properties

Tarpon Springs and Holiday, Florida

CERCLIS # FLD010596013

January 14, 1998

Prepared by:
ENERGY SECTION
FEDERAL FACILITIES ASSESSMENT BRANCH
DIVISION OF HEALTH ASSESSMENT AND CONSULTATION
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, is an agency of the U.S. Public Health Service. It was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of a health threat, if any, posed by a site and recommends ways to stop or reduce exposure in its public health action plan. ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible for cleaning up the site, and the community. It then shares its conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When informed of ATSDR's conclusions and recommendations, sometimes the agencies will begin to act on them before the final release of the report.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

TABLE OF CONTENTS

TABLES

FIGURE

SUMMARY

From 1947 to 1981, the Stauffer Chemical Company in Tarpon Springs, Florida, made elemental phosphorus from phosphate ore. While the plant was in operation, phosphate slag was transported off site and used as aggregate in road bedding, road and driveway paving, and in concrete structures. The extent of the distribution could not be determined. Residents in the area expressed concern about possible adverse health effects resulting from exposure to radium and heavy metals leaching from phosphate slag that was used in nearby roads and buildings. Besides radium, other contaminants of concern to residents were arsenic, asbestos, uranium, radon, and ionizing radiation.

There is a completed exposure to ionizing radiation from radium contaminated slag and aggregate, and exposures are not expected to result in any adverse health outcomes, however the levels of ionizing radiation at one residence exceed both national and international guidelines for exposure by a factor of two.

Contaminated slag contains concentrations of metals above background levels, but does not appear to represent a public health hazard. Combined exposures from roads and driveways are not a health threat. ATSDR recommends that public health education be provided, to help the public better understand that there is no public health hazard posed by the phosphate slag.

BACKGROUND

In February 1998, the Agency for Toxic Substances and Disease Registry (ATSDR) received a petition from a Tarpon Springs, Florida, resident. The person requested that the agency investigate health problems that might be associated with exposure to slag materials used in residential areas of Tarpon Springs. Since then, ATSDR has responded to letters from several other residents. The U.S. Environmental Protection Agency (EPA), Region IV also requested that ATSDR review the sampling data taken at several vicinity properties near the Stauffer Superfund site in Tarpon Springs. EPA asked ATSDR to review chemical and radiological sampling data of residential slag, to propose exposure scenarios, to provide radiological dose estimates, and to make recommendations for protection of public health.

Since receiving letters from concerned Tarpon Springs' residents, ATSDR staff members have begun investigating residents' health concerns and possible associations between those concerns and exposures to hazardous substances.

A. Site Description and History

From 1947 to 1981, the Stauffer Chemical Company (which operated under different ownership until 1960) made elemental phosphorus from phosphate ore using an arc furnace process. The processed ore was shipped off site to produce agricultural products, food-grade phosphates, and flame retardants. While the chemical plant operated, waste products (i.e., slag) were disposed of on the plant property, shipped off site by rail, and were given to local residents to be used as fill and aggregate.

The Stauffer plant was added to the EPA Superfund list in 1994 because of pollution on the site. Superfund is a federal program for finding and cleaning up hazardous waste sites in this country. Since 1994, EPA has been working to clean up the Stauffer site. EPA is testing and monitoring the soil, water, and air at the site and at vicinity properties to protect nearby residents against health problems that might result from exposure to hazardous waste.

B. Site Visit

In May 1998, ATSDR staff members visited Tarpon Springs to meet with residents and to gather more information. Staff members addressed residents' questions. ATSDR and EPA Region IV personnel visited several vicinity properties in Tarpon Springs and Holiday, Florida. They saw the Stauffer Chemical Superfund site from the site boundary including the Anclote River. During a boat tour on the Anclote River, ATSDR and EPA were shown where slag from the site was used to fill in an inlet on site property.

In August 1998, EPA Region IV personnel and staff from EPA's National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama, took samples of building materials and roads and performed radiological surveys of several vicinity properties.

C. Demographics, Land Use and Natural Resources

The City of Tarpon Springs is in Pinellas County, Florida. The community is near the Anclote River, about 1.6 miles east of the Gulf of Mexico. Gulfside Elementary School is directly across the street from the Stauffer site and Tarpon Springs Middle and High Schools are also in close proximity.

According to 1990 census data (1), 9,231 people live within a one-mile radius of the site. About 97% of the population is white and 2.2% are black, with most being middle income level. A hospital, a nursing home, and a children's group home are within one mile of the site. There are about 100 private wells within this same area. The color maps on the following page give a graphical representation of the demographic data (see figure 1).

D. Health Outcome Data

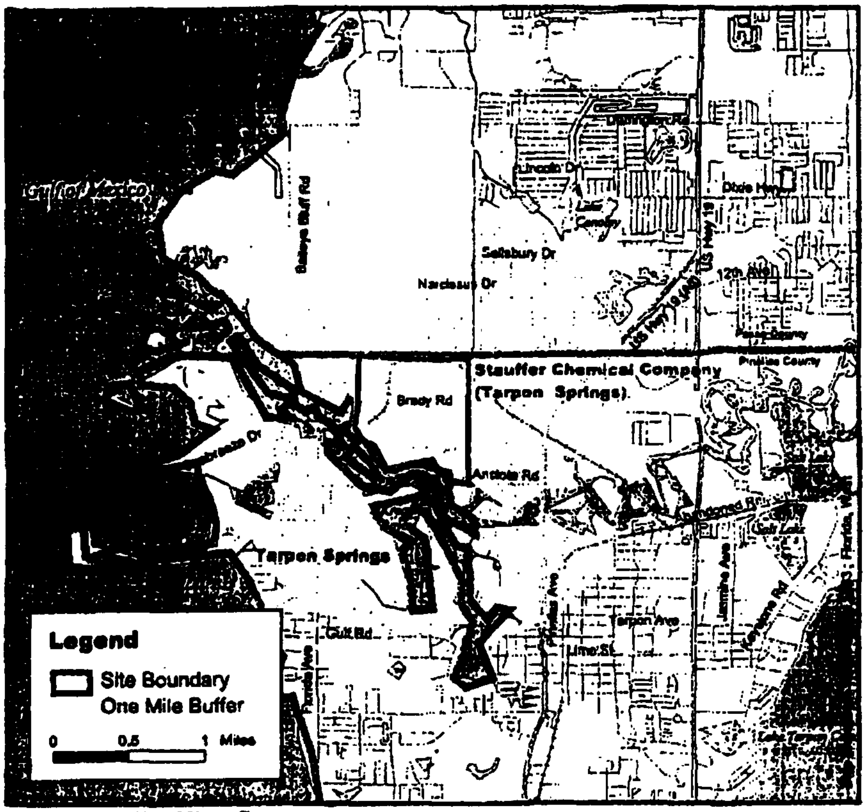
Evaluation of available health outcome data did not find any elevated mortality rates for leukemia, bone cancer, or respiratory diseases. Rates for Pasco and Pinellas Counties were below the state averages for both respiratory disease and childhood leukemia and bone cancers.

Mortality data were analyzed for various respiratory diseases (ICD Codes 460 to 519.9) and for childhood radiogenic cancers (ICD Codes 204 to 204.9) in Florida counties surrounding the Stauffer site. Respiratory diseases were looked at, because of the dusts emitted from Stauffer Chemical when it was operating. ATSDR used the *Wide-ranging ONline Data for Epidemiologic Research* (*WONDER)* system, which is a computer database designed by the Information Resources Management Office, Centers for Disease Control and Prevention (CDC), Public Health Service. The mortality section of the database provided information for comparing the rates of the county with rates for the state and the rest of the country.

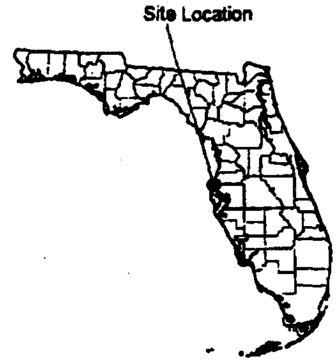
Stauffer Chemical Company (Tarpon Springs)

Tarpon Springs, Florida

CERCLIS No. FLD010596013



Base Map Source: 1995 TIGER/Line Files



Pinellas County, Florida

Demographic Statistics Within One Mile of Site*	
Total Population	9231
White	8936
Black	208
American Indian, Eskimo, Aleut	26
Asian or Pacific Islander	35
Other Race	23
Hispanic Origin	208
Children Aged 6 and Younger	549
Adults Aged 65 and Older	2940
Females Aged 15 - 44	1465
Total Housing Units	4906

Demographics Statistics Source: 1990 U.S. Census
*Calculated using an area-proportion spatial analysis technique

Population Density

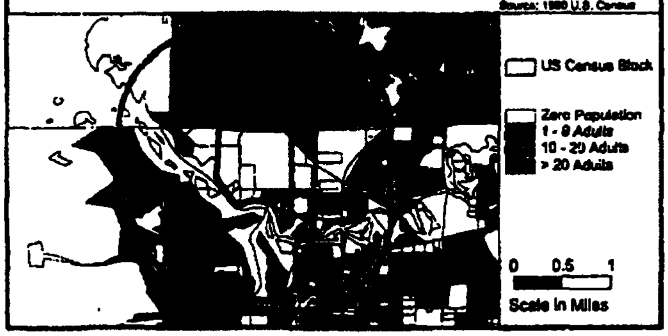
Source: 1990 U.S. Census

Children 6 Years and Younger

Source: 1990 U.S. Census

Adults 65 Years and Older

Source: 1990 U.S. Census



Females Aged 15 - 44

Source: 1990 U.S. Census

JVA102366

SAAGIS

COMMUNITY HEALTH CONCERNS

Residents from Tarpon Springs, and Holiday, Florida expressed concern about adverse health effects resulting from exposure to radium and heavy metals leaching from phosphate slag that was used in nearby roads and buildings. Besides radium, other contaminants of concern to residents were arsenic, beryllium, uranium, radium, radon, and ionizing radiation.

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

A. Contamination

ATSDR reviewed the report of the radiological survey that EPA Region IV conducted during the week of August 23, 1998 (2). The gamma radiation surveys were taken at four off site residences near the Stauffer Chemical Superfund site in Tarpon Springs, Florida. Slag and soil samples were taken at 10 residences and chemically analyzed (3) to determine if there was a toxicological risk to the public and also to compare the contaminants in the off site slag to those at the Stauffer site. Slag appeared to be in a sintered form (i.e., trapped in a glass like matrix), consistent with an arc furnace extraction process. Samples were analyzed for aluminum, antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cobalt, copper, iron, manganese, mercury, nickel, radium, selenium, silver, thallium, vanadium, fluoride, and zinc.

ATSDR staff also reviewed relevant tests conducted by EPA representatives (2,3) and health-related reports issued by the Florida Department of Health (FDOH). The FDOH, through a cooperative agreement with ATSDR, has issued a public health assessment for the Stauffer site (4) and a health consultation for the Gulfside Elementary School in Holiday, Florida (5).

The Appendix contains the radiological survey and sampling data from the site visit (Stauffer Chemical Vicinity Properties) during the week of August 23, 1998.

Static gamma radiation surveys were taken in four residences using a pressurized ion chamber (PIC). This instrument is calibrated in microrad per hour (µrad/hr) and was provided and operated by the EPA's National Air, Radiation and Environmental Laboratory (NAREL). Comparison surveys were taken at the same locations with a Bicron Micro Rem meter, S/N B792W, calibration date of August 4, 1998. Measurements were taken at both waist level (normal standard for exposure surveys) and ground level for comparison purposes.

The hurricane proof construction style of residence #1 (see Table 1) is different than any other home encountered. The floors and some walls on both levels are poured concrete that use phosphate slag as aggregate. This resulted in the basement floor's having more than twice the gamma dose rate of the upstairs living space.

B. Quality Assurance and Quality Control

In preparing this public health assessment (PHA), ATSDR relied on the information provided in the referenced documents. The agency assumed that adequate quality assurance and quality control measures were followed with regard to chain-of-authority, laboratory procedures, and data reporting. The validity of the analyses and the conclusions drawn in this document was determined by the availability and reliability of the referenced information.

PATHWAYS ANALYSIS

At the time of the PHA, there was a completed exposure pathway from ionizing radiation. EPA samples of selected residences found that driveways, yard fill, home foundations, and other concrete structures contained phosphate slag with high concentrations of the natural radium isotope Ra-226 (3). Radiation dose measurements in several homes were elevated above background, but not sufficient to represent a health hazard. The normal background for the Tarpon Springs area was about 60 millirem per year (mrem/yr), excluding the contribution from radon. If you include the dose from radon for this part of Florida, the annual background dose is about 160 mrem/yr. Florida has a rather low background dose compared to Denver, Colorado, which is about 300 millirem (including the contribution to total dose from radon). The International Council on Radiation Protection (ICRP) recommends that radiation doses to the public not exceed 500 millirem in any 5 year period and should be less than 100 millirem per year over a lifetime. This excludes doses from background (i.e., natural sources), diagnostic (e.g., x-rays) and other medical exposures(6). The lowest observed adverse effect level (LOAEL) from ionizing radiation is from 10 to 25 rem in one exposure and is seen as a slight decrease in blood cell count (7).

Radon samples in homes were all below EPA's action level of 4 pCi/L, and did not find any radon gas coming from radium contaminated slag. The lack of radon would be expected from the glass-like character of the slag. The glass-like property of the slag would also impede leaching of heavy metals present.

Assuming a conservative occupancy factor of 17 hours per day to contaminated parts of the residence and an hour on contaminated driveway for 350 days per year, the annual radiation doses excluding background could be as high 210 millirem per year (mrem/yr) at residence #1 (see Table 1 in the appendix), and as low as 41 mrem/yr at residence #3 (see Table 3 in the appendix). No infants or elderly individuals, who would be expected to be home more than 17 hours per day, lived in the most contaminated homes. Using a conservative exposure model for a maximally exposed child in the most contaminated home, the expected annual dose was more than twice the ICRP's and National Council on Radiation Protection and Measurement's (NCRP) recommendation for exposures to the public (6,8).

PUBLIC HEALTH IMPLICATIONS

All the radium levels sampled at off site residences and the associated gamma radiation were elevated above background levels. The ICRP (6) and the NCRP (8) recommend limiting annual exposure to external radiation to 100 mrem/yr above background levels, excluding exposures from medical procedures. The LOAEL from ionizing radiation is from 10 to 50 rem in a short period of time (i.e. less than a week) and is seen as a slight decrease in blood cell count (7). (Note: A rem is equivalent to a rad for gamma radiation and one rem is equivalent to 1,000 millirem.)

Of the four homes sampled in the Tarpon Springs area, only one exceeded any recommended health limits of the ICRP and NCRP. Residence #1 had significantly elevated radiation levels, especially in the basement. Using a conservative scenario, the annual dose to someone living in a basement bedroom could receive about 210 mrem/yr above background. That is over twice the limit recommended by the ICRP and NCRP. No other homes tested approached the recommended limit of 100 mrem/yr.

The ICRP and NCRP recommendations are very conservative and are a factor of 100 below the LOAEL for acute exposure to ionizing radiation. Even though the total dose inclusive of background would be 250 mrem/yr, this is still below the national average background dose in the United States of 300 mrem/yr (9). No adverse health effects would be expected from residing in the most contaminated home.

For non-radioactive chemicals and metals, ATSDR uses comparison values (contaminant concentrations in specific media and for specific exposure routes believed to be without risk of adverse health effects) to select contaminants for further evaluation. ATSDR and other agencies have developed the values to provide guidelines for estimating media contaminant concentrations that are not likely to cause adverse health effects, given a standard daily ingestion rate and standard body weight. Table 5 lists environmental media exposure guidelines (EMEGs) and reference media exposure guidelines (RMEGs).

Many of these values have been derived from animal studies. Health effects are related not only to the exposure dose, but to the route of entry into the body and the amount of chemical absorbed by the body. Several comparison values might be available for a specific contaminant. To protect the most sensitive segment of the population, ATSDR generally selects the comparison value that uses the most conservative exposure assumptions.

Special Considerations of Women and Children

Women and children may sometimes be affected differently from the general population by contaminants in environmental media. For one thing, they are smaller than the population average, and so are affected by smaller quantities of the contaminants. The effect of hormonal variations, pregnancy, and lactation can also change the way a woman's body responds to some substances. Exposure during pregnancy and lactation can expose the woman's fetus or infant to the substances if they cross her placenta or get into her milk. Depending on the stage of her pregnancy, exposure of her fetus could result in its death (miscarriage or stillbirth) or impaired development (birth defects). If she is exposed during lactation, her milk may concentrate certain contaminants, increasing the exposure of her infant above that of her own.

ATSDR's Child Health Initiative recognizes that unique vulnerabilities are inherent in the developing young, whether fetus, infant, or child. Public health assessments need to include evaluations of potential effects on the young in light of these unique parameters. For example, children are not just "small adults." Children are smaller, and so some exposures would affect them more because of their reduced body weight and higher ingestion rate, resulting in an increased dose or amount taken into the body compared to the body weight. A child's shorter height results in higher gamma radiation dose from contaminated concrete floors and the need to base dose estimates at half a meter rather than one meter.

In addition to physical and behavioral differences, the young have heightened susceptibility stemming from other causes.

Children's metabolic pathways, especially in the first months after birth, are less developed than those of adults. While in some instances children are better able to deal with environmental toxins, in others, they are less able and are thus more vulnerable. Some chemicals that are not toxins to adults are highly toxic to infants.

Children are undergoing rapid growth and development in the first months and years of life. Some organs systems, especially the nervous and respiratory systems, may experience permanent dysfunction if exposed to high concentrations of certain contaminants during this period. In addition, because of the more rapid growth and development, a child's DNA is more likely to be exposed than later in life, rendering this period of life more vulnerable to genotoxic insult.

Children have more future years than adults, so exposure during early years leaves more time for development of chronic diseases. This would be especially true in the case of multistage diseases (e.g., cancer) which may require many years to progress from earliest initiation to actual manifestation of illness.

Finally, children have less ability to avoid hazards in that they are dependent on adults for decisions which may have effects on children but not adults. Adults may not recognize circumstances hazardous to children, especially those not hazardous to adults.

CONCLUSIONS

1. Contaminated slag from the Stauffer Chemical Superfund site, reportedly has been used as concrete aggregate in homes, roads and roadbeds in the Tarpon Springs and Holiday, Florida vicinity.

2. Because of the special hurricane resistant poured concrete and steel I-beam construction of residence #1, the levels of ionizing gamma radiation at that residence exceed, national and international recommendations for exposure of members of the public from ionizing radiation by more than a factor of two.

3. Although there is a completed exposure pathway for ionizing radiation from radium-contaminated slag and aggregate, the doses residents are exposed to is still below the national average background dose of 300 mrem per year. Adverse health effects would not be expected until background levels are exceeded by 10 rem above background.

4. Contaminated slag at sampled vicinity properties, does not appear to contain sufficient heavy metals to represent a public health hazard.

5. Combined exposures from contaminated driveways and roads are not a health threat.

RECOMMENDATION

1. Those living at residence #1 should limit their time in the basement and not have sleeping quarters on the basement level.

2. ATSDR recommends disassociating the contaminants from residents of residence #1.

3. ATSDR recommends that public health education be provided to help the public better understand that there is currently no general public health hazard posed by the phosphate slag.

A Health Activity Recommendation Panel (HARP) was assembled to identify needed public health actions based on the findings of the Stauffer Chemical Vicinity Properties public health assessment. The HARP determined that, where needed and requested, an environmental health education program should be undertaken to provide information to community members on the environmental health effects presented in the Stauffer Chemical Vicinity Properties public health assessment.

PUBLIC HEALTH ACTION PLAN

The public health action plan for the Stauffer Chemical Vicinity Properties contains a description of actions to be taken by the Agency for Toxic Substances and Disease Registry (ATSDR) and other government agencies at and in the vicinity of the site after the completion of this public health assessment. The purpose of this Public Health Action Plan is to ensure that this public health assessment not only identifies public health hazards but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment.

Upon request from the public, the Florida Department of Health (FDOH) will develop and implement an environmental health education program to help community members understand the potential for past exposure and to provide information on assessing any adverse health occurrences that might be related to phosphate slag.

PREPARER OF REPORT

Author

Michael D. Brooks, CHP
Health Physicist
Federal Facilities Assessment Branch
Division of Health Assessment and Consultation
ATSDR

REFERENCES

1. Bureau of the Census, U.S. Department of Commerce, Washington, DC, 1990 Census Data Files.

2. Memorandum dated September 2, 1998, from Rick Button, Health Physicist to John Blanchard, Remedial Project Manager, US EPA. Report on radiological surveys conducted and observations for the offsite Stauffer Chemical visit of August, 1998 in Tarpon Springs, FL.

3. Memorandum dated September 17, 1998, from John Griggs, Chief Monitoring and Analytical Services Branch to John Blanchard, US EPA Region IV, Waste Division. Radiochemical results for Tarpon Springs Samples.

4. Florida Department of Health. Preliminary Public Health Assessment for Stauffer Chemical Company/Tarpon Springs, Tarpon Springs, Pinellas County, Florida. FDOH: Tallahassee, August 4, 1993.

5. Florida Department of Health, Bureau of Environmental Toxicology, Under Cooperative Agreement with the Agency for Toxic Substances and Disease Registry, Health Consultation for the Gulfside Elementary School, Holiday, Florida dated June 18, 1998.

6. ICRP (1990). International Commission on Radiological Protection (ICRP) Recommendations of the International Commission on Radiological Protection. ICRP Publication 60. New York: Pergamon Press. 1990.

7. National Council on Radiation Protection and Measurements. Influence of Dose and Its Distribution in Time on Dose-Response Relationships for Low-LET Radiations, NCRP Report No. 64. NCRP: Bethesda, 1980.

8. National Council on Radiation Protection and Measurements. Limitation of Exposure to Ionizing Radiation, NCRP Report No. 116. NCRP: Bethesda, March 31, 1993.

9. National Council on Radiation Protection and Measurements. Exposure of the Population in the United States and Canada from Natural Background Radiation, NCRP Report No. 94. NCRP: Bethesda, December 30, 1987.

Appendix

The observed radiation background for similar residences was 6-7 microrad per hour (µrad/hr). Average dose rates in affected areas ranged from 15.4 to 39.1 µrad/hr, including background (or 10 to 33 µrad/hr above background). One rad is equivalent to one rem for gamma radiation. The recommended average annual dose limit to members of the public from ionizing radiation is 100 millirem per year, per the International Commission on Radiation Protection (ICRP) (6).

Table 1 Stauffer Chemical Vicinity Properties - Residence 1

Location	Residence 1	µr/hr (waist level)	µr/hr ground level	Average
#1	basement	42	49	45
#2	basement	38	44	41
#3	basement	43	48	46
#4	basement	47	51	49
#5	basement	44	51	47
#6	basement	31	41	36
#7	basement	45	46	45
#8	basement	30	44	37
#9	basement	46	53	49
#10	basement	42	48	45
#11	bedroom	31	41	36
#12	bedroom	30	39	35
#13	1st floor	14	17	16
#14	1st floor	20	28	24
#15	1st floor	10	9	10
#16	1st floor	19	26	22
#17	1st floor	26	29	27
#18	1st floor	25	31	28
#19	1st floor	11	12	11
#20	1st floor	9	11	10
#21	driveway	29	38	34
#22	driveway	29	39	34
#23	driveway	60	73	67
Average	living areas	16.7 (1st floor)		
Annual Dose (mrem)				210

Note: One rad is equivalent to one rem for gamma radiation. One thousand microrad (µrad) are equivalent to one millirad (mrad).

To calculate an Annual Dose, because there were small children in the home, took an average of the one meter and ground level measurements, then subtracted background=6 µrad/hr and assumed 12 hours per day in the bedroom, 5 hours in the basement, 1 hour on the first floor and an hour on the driveway for 350 days per year.

Table 2 Stauffer Chemical Vicinity Properties - Residence 2

Location:	Residence 2	µrad/hr (waist level)	µrad/hr (ground level)
#1	bedroom	20	n/a
#2	bedroom	21	n/a
#3	bedroom	20	n/a
#4	bedroom	22	n/a
#5	bedroom	26	n/a
#6	bedroom	27	n/a
#7	bedroom	28	n/a
#8	bedroom	21	n/a
#9	bedroom	25	n/a
#10	bedroom	27	n/a
#11	bedroom	29	n/a
#12	bedroom	27	n/a
#13	bedroom	21	n/a
Annual Dose		76 (mrem)	n/a

Note: One rad is equivalent to one rem for gamma radiation. One thousand microrad (µrad) are equivalent to one millirad (mrad). To calculate an Annual Dose, subtracted background=6 µrad/hr and assumed 12 hours per day in the bedroom and 5 hours in other parts of the house for 350 days per year.

Table 3 Stauffer Chemical Vicinity Properties - Residence 3

Location:	Residence 3	µrad/hr (waist level)	µrad/hr (ground level)
#1	o/s slab	25	n/a
#2	o/s slab	25	36
#3	o/s slab	19	n/a
#4	o/s slab	19	34
#5	o/s slab	22	n/a
#6	o/s slab	29	36
#7	o/s slab	22	n/a
#8	o/s slab	23	n/a
#9	living room	22	21
#10	living room	19	23
#11	living room	19	26
#12	living room	20	26
#13	kitchen	20	22
#14	kitchen	19	26
#15	bathroom	15	16
#16	o/s bathroom	15	16
#17	side bedroom	8	9
#18	back left bedroom	7	6
#19	back right bedroom	15	13
#20	back right bed	7	6
Annual Dose		41 (mrem)	

Note: One rad is equivalent to one rem for gamma radiation. One thousand microrad (µrad) are equivalent to one millirad (mrad). To calculate an Annual Dose, subtracted background=6 µrad/hr and assumed 12 hours per day in the bedroom, 5 hours in other areas of the house and 1 hour on the outside slab for 350 days per year.

Table 4 Stauffer Chemical Vicinity Properties - Residence 4

Location:	Residence 4	µrad/hr (waist level)	µrad/hr (ground level)
#1	garage	21.5	36.1
#2	garage	25.7	37.1
#3	garage	21.7	25.7
#4	garage	21.5	35.7
#5	foyer	10.2	n/a
#6	foyer	9.4	n/a
#7	foyer (by door)	13.0	n/a
#8	adjacent bath	12.1	n/a
#9	adjacent bath	9.8	n/a
#10	back door	11.4	n/a
Annual Dose		50 (mrem)	

Note: One rad is equivalent to one rem for gamma radiation. One thousand microrad (µrad) are equivalent to one millirad (mrad). To calculate an Annual Dose, subtracted background=6 µrad/hr and assumed 12 hours per day in the house and 5 hours in the garage for 350 days per year.

Table 5 Maximum Contaminant Concentrations in Parts per Million (ppm)

Contaminant	Driveway Pavement	Driveway Base	Yard Soil	Comparison Value
Antimony	0.0566	0.252	0.0469	20 (Chronic RMEG Child)
Arsenic	4.85	3.84	0.829	20 (Chronic RMEG Child)
Beryllium	1.24	1.92	0.749	100 (Chronic RMEG Child)
Chromium	27.7	22.3	49.6	200 (Chronic RMEG Child)
Lead	18.2	11.7	31.8	None
Thallium	0.70	0.614	0.0658	5 (Chronic RMEG Child)
Vanadium	33.9	26.3	17.2	200 (Intermediate EMEG Child)
Radium-226	70.2 (pCi/g)	6.21 (pCi/g)	25.1 (pCi/g)	5 pCi/g to 5 cm depth 15 pCi/g below 5 cm (40 CFR 192)

Key: Reference Media Exposure Guideline (RMEG)
Environmental Media Exposure Guideline (EMEG)
EPA Standards for Uranium and Thorium Mill Tailings {40 CFR 192 (1983)}
Code of Federal Regulations (CFR)

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION 4

SUPERFUND FACT SHEET

RESULTS OF EPA GAMMA RADIATION SURVEYS AND SAMPLING OF SLAG MATERIALS TAKEN IN THE TARPON SPRINGS AREA IN JUNE - AUGUST 1998

January 1999

In this Fact Sheet:

- *Purpose of Sampling for Radiation*
- *Previous sampling activities; sampling locations and results*
- *Criteria used for evaluating results*
- *Enforcement activities*
- *ATSDR Public Health Assessment*
- *Recommendations/conclusions*
- *Public Meeting/Public Involvement*

The U.S. Environmental Protection Agency (EPA) Region 4 conducted surveys and sampling for gamma radiation and non-radiological contaminants in Tarpon Springs, Florida and the surrounding counties in June, July, and August of 1998. These activities were requested by local residents who felt that contaminants may have been, distributed from the Stauffer Chemical Company Superfund site in Tarpon Springs (site) into the surrounding communities and may be adversely affecting their health. This fact sheet highlights EPA's sampling activities and summarizes a concurrent health assessment conducted by the Agency for Toxic Substances and Disease Registry (ATSDR). Also, the fact sheet provides interpretation of the results and, recommendations, and proposed dates for the public meeting.

PUBLIC MEETING

EPA will hold a public meeting to discuss the Offsite Sampling Results on January 28, 1999 at the Tarpon Springs High School from 6:30 until 7:30p.m. located at 1411 Gulf Road West, Tarpon Springs, Florida. Please read the information contained within this fact sheet, and prepared all questions in writing prior to the meeting in order to abide by the time-frame allotted by this facility.

INVESTIGATION BACKGROUND

Local residents expressed concerns that slag was transported from the Stauffer Chemical Company

(Tarpon Springs) site and used as a construction material in roads, driveways, houses, and other structures in the communities surrounding the site (offsite areas). The Stauffer Chemical Company and their predecessor manufactured elemental phosphorous from 1947 until 1981 using phosphate ore mined from deposits in Florida. A by-product of the elemental phosphorous production process was phosphate slag (slag). The rock-like slag material contains radium-226 and a host of metallic contaminants.

Past Surveying/Sampling Activities - State of Florida

The Florida Department of Environmental Protection (FDEP) and the Florida Department of Health, Bureau of Radiation Control (DOH-BRC) conducted gamma radiation surveys on roadways, driveways, and building interiors and analyzed 10 slag samples for the presence of nine non-radiological, site-related contaminants in July through December 1997. Based on these analyses, the Florida Department of Health prepared a health consultation which recommended no further action.

EPA Region 4 Surveying and Sampling Activities

At the request of the community, EPA agreed to expand the previous FDEP and DOH-BRC activities by conducting additional gamma radiation surveys, and collecting and evaluating additional samples of roads, driveways, yards, and home interiors in the City of Tarpon Springs and surrounding areas in Pinellas and Pasco Counties. The EPA conducted these activities in June through August 1998 as discussed below:

June 25, 1998 Gamma Radiation Screening Surveys by EPA

The EPA conducted gamma radiation screening surveys in two homes, four driveways, and three roadways, using a Ludlum Model 19 Micro R meter (Ludlum) to determine the best sampling locations. The Ludlum, which is calibrated to Cesium-137, provides a conservative result when surveying for Radium-226. EPA used the results of these surveys, combined with review of the previous DOH-BRC surveys and discussions with residents, as a basis for selecting locations for the July sampling event.

July 7-10, 1998 Sampling Event by EPA

The U.S. EPA's Science and Ecosystems Support Division, Athens, GA (SESD) collected 26 samples as shown in Table 1 (plus QA/QC and background samples) and shipped them to EPA's National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama for chemical and radiological analysis. The purpose of the analysis was to determine the presence and concentrations of site-related radiological and non-radiological contaminants in the samples. The site-related contaminants evaluated are discussed in the Results section below. In addition, the EPA sent two samples from the offsite areas and one sample from the site to the Idaho National Engineering and Environmental Laboratory (INEL) for visual and microscopic comparison. The purpose of this analysis was to determine whether the offsite slag materials could be scientifically "fingerprinted" to the Stauffer slag.

Table 1 - Sampling Locations July 7-10, 1998

Media	Number of Samples
Driveway Paving	4
Driveway Base	4
Road Paving	4
Road Base	4
Yard Soils	4
Slag Pile in Yard	1
Basement Slab on Grade	1
Basement Slab Base	1
Right of Way Paving	1
Right of Way Base	1
Stauffer Slag Field	1

August 23-26, 1998 Re-Surveying of Homes for Interior Gamma Dose

During the gamma radiation screening surveys conducted by EPA using the Ludlum, it was determined that four homes exceeded interior gamma dose levels recommended by 40 CFR Part 192, the "Uranium Mill Tailings Act" (20 uR/hr + background). The EPA and NAREL conducted additional surveys in these homes using a Pressurized Ionization Chamber (PIC) and a Bicron Microrem Meter. The PIC and Bicron meter measure all radioisotopes and measure body tissue dose; their results are more realistic.

RESULTS

Slag and Soil Sampling

All samples were evaluated for dermal contact, incidental ingestion, and inhalation, as if the slag was soil. While the crumbling of slag roads and generation of dust was observed during the gamma survey and sampling events, the evaluation of all slag material as loose soil is highly conservative.

Carcinogens

Carcinogenic (cancer-causing) contaminants were evaluated in accordance with EPA's procedures for determining Total Lifetime Excess Cancer Risk (risk). EPA considers chemical concentrations posing a risk in excess of 1 in ten thousand (1×10^{-4}) to require further action. Soil in which the cumulative contaminant concentrations exceed the 1×10^{-4} risk (trigger concentration) would require EPA action. Table 2 provides a list of the site-related carcinogens evaluated, the maximum levels detected, trigger concentrations corresponding to the 1×10^{-4} risk, and the source of the trigger concentrations. Note that site-related carcinogenic polyaromatic hydrocarbons are not shown because they were not detected in the samples collected.

Table 2 - Site Related Carcinogens Detected in Offsite Areas - Maximum Concentrations

Contaminant	Maximum Concentration Detected	10^{-4} Trigger	Source
Arsenic	4.35 ppm	40 ppm	Site*
Ra-226 Ingestion	70.2 pCi/g	268 pCi/g	EPA Risk**
Ra-226 Inhalation	70.2 pCi/g	4807600 pCi/g	EPA Risk**

*EPA Region 4 does not consider arsenic in soil to be a carcinogen; however, it does consider arsenic to be a carcinogen in drinking water. If the assumption was made that arsenic is a carcinogen in soil, then the safe soil level for children would be a 10^{-6} risk level of 0.48 ppm; the 10-4 trigger would be 100 times higher, approximately 40 ppm.

** EPA calculated the trigger levels for ingestion and inhalation in accordance with the EPA's "Risk Assessment Guidance for Superfund."

The excess lifetime cancer risks due to all carcinogens from a given sample were added to determine if their combined effect exceeded the trigger of 1×10^{-4} for that sample. All samples were below the 1×10^{-4} trigger level.

Conclusion: The total excess lifetime cancer risk at all sample locations was below the 1×10^{-4} trigger .

Table 3 - Site Related Non-Carcinogens Detected in Offsite Areas - Maximum Concentrations			
Contaminant	Maximum Concentration Detected (ppm)	PRG (ppm)	Source
Aluminum	11900	72000	FAC
Antimony	0.298	26	FAC
Arsenic*	4.85	21	EPA
Barium**	136	5200	EPA
Beryllium	1.96	120	FAC
Cadmium	1.82	75	FAC
Chromium	49.6	290	FAC
Cobalt	7.55	4700	FAC
Copper**	64.8	2800	EPA
Iron	3500	23000	FAC
Lead	48	400	EPA
Manganese	187	1500	FAC
Mercury	0.0369	3.7	FAC
Nickel**	34.4	1500	EPA
Selenium	2	390	FAC
Silver	0.222	390	FAC
Thallium	0.7	6	EPA
Vanadium**	36.6	520	EPA
Fluoride***	1300	3900	EPA
Zinc	100	23000	FAC

*The FAC does not provide PRGs for the non-carcinogenic effects of Arsenic or Thallium. EPA Region 9 risk-based numbers were used.
** The FAC PRGs for these chemicals are based upon an acute (one time) exposure to a large amount of ingested soil. EPA PRGs are based on long-term chronic exposure to a typical amount of soil that would be ingested by incidental exposure. EPA believes the latter exposure scenario represents the appropriate basis for developing cleanup levels.
***Samples were not evaluated for Fluoride; the concentration shown is from a previous on-site slag sample.

Non-Carcinogens

Non-carcinogenic contaminants (toxic but not cancer-causing) were evaluated by comparing the contaminant concentrations detected in the samples with established Preliminary Remediation Goals (PRGs) for specific target organs (such as nervous system, skin, small intestine, etc). The contaminants evaluated, maximum levels detected, PRGs, and the source of the PRGs are shown in Table 3. Table 3 consists entirely of metals. Volatiles were not detected in any of the samples. For each sample location, the hazard quotients for each contaminant were added to determine if their cumulative effect exceeded the total allowable hazard associated with non-carcinogenic contaminants (Hazard Index). In one case, this Hazard Index was exceeded. However, upon comparing the individual hazard quotients to the PRGs for each target organ, it was determined that the levels were acceptable.

Conclusion: Non-carcinogenic contaminant concentrations are within acceptable levels at all locations.

Whole-Body Gamma Radiation Dose

Gamma Radiation Dose Screening Criteria

There are numerous maximum recommended radiation doses provided by several sources. These sources included the Florida Administrative Code (FAC), 40 CFR Part 192, National Council on Radiation Protection (NCRP), and Health Consultations issued by the ATSDR. Based upon the review of these screening criteria, the EPA selected the screening criteria for the analysis of the offsite areas as shown in Table 4. All readings were taken at waist level unless otherwise noted.

Table 4 Gamma Radiation Dose Screening Criteria		
Location Type	Suggested Criteria	Source
Interior Residential	20 uR/hr[1]	40 CFR 192
Total Residential Property[2]	200 mRem/yr[1]	ATSDR Health Consult[4]
Roadway[3]	500 mRem/yr[1]	NCRP and FAC

[1] All levels shown do not include background.
[2] 18 hrs/day in house, 2 outdoors, 350 days per year
[3] Walking on road for 2 hours/day, 350 days/year
[4] ATSDR 1992 Health Consult, Austin Ave Radiation Superfund Site

Residential Gamma Dose Surveys - Home Interiors

EPA Region 4 surveyed five residential interiors. As noted previously, four of those interiors exceeded the 20 uR/hr +background dose recommended by 40 CFR Part 192 when surveyed using the Ludium. When re-surveyed using the PIC, only one home remained above the recommended interior dose. Table 5 shows the results for those homes re-surveyed using the PIC.

Table 5 Average Interior Gamma Doses Using PIC Including Background*		
Residence	Room Surveyed	Interior Gamma Dose - PIC
1	Basement	40 uR/hr
1	First Floor	17 uR/hr
2	Master BR	24 uR/hr
3	Living Room	20 uR/hr
4	Garage/Shop	23 uR/hr

* Ave Background in Florida is uR/hr. The criteria including background is 20 uR/hr + 6 uR/hr = 26 uR/hr.

Conclusion: One home exceeds the recommended criteria for interior gamma dose of 26 uR/hr including Background.

Residential Gamma Dose Surveys - Driveways

EPA Region 4 surveyed five driveways. The results are shown in Table 6.

Table 6 Gamma Radiation Doses - Driveways	
Driveway Location	Gamma Dose (uR/hr) (Incl. Background)
1	45
2	40
3	23
4	180
5	140

Residential Gamma Dose Calculations - Total Property

Table 7 illustrates the total gamma radiation dose of five properties sampled.

Table 7 Total Property Gamma Radiation Dose (Excluding Background)			
Propert y	Interior Dose (mRem/yr)	Driveway Dose (mRem/yr)	Total Dose (mRem/yr)
1	205	28	233
2	87	13	100
3	59	122	181
4	0	94	94
5	114	24	138
6	107	Backgnd	107

Conclusion: One whole property exceeds the criteria established for this analysis in Table 4; that exceedance is due primarily to the interior gamma dose as shown in table 6. Residential driveways do not exceed the recommended criteria.

Gamma Radiation Dose Surveys -Roadways

EPA Region 4 surveyed four roadway locations. The hourly doses and calculated annual doses for three of the locations are provided in Table 8.

Table 8 Gamma Radiation Surveys Results and Calculated Annual Doses - Roadways			
Road Location	Hourly Dose Including Background	Hourly Dose Not Incl. Background	Annual Dose (mRem/yr)
1	190 uR/hr	184 uR/hr	129
2	180 uR/hr	174 uR/hr	122
3	190 uR/hr	184 uR/hr	129

Conclusion: None of the roadways sampled exceeded the recommended gamma radiation dose criteria of 500 mRem/yr.

Radon Sampling

EPA tested four home interiors for radon; all results were below the recommended 4 pCi/L level.

Conclusion: Phosphate slag is not producing unacceptable levels of radon inside of residences.

Enforcement Activities

EPA has verified through information provided by Stauffer Management Co., local citizens, and a national railroad company, that slag materials were taken from the site and used as construction material in offsite areas. The extent of distribution is unknown at this time.

In addition, EPA has determined that another plant in Nichols, FL manufactured elemental phosphorous using the same process, and distributed slag in the same manner as was done by Stauffer Chemical Company and its predecessor, in the same time period. The extent of distribution from this plant is also unknown. Additional potential sources of slag material may also exist.

Conclusion: Slag has been distributed by Stauffer Chemical Co., its predecessor. The extent of distribution is unknown. A similar elemental phosphorous plant in Nichols, Florida also distributed slag material.

Onsite vs. Offsite Slag Fingerprinting/Comparison

EPA Region 4 sent one sample from a residential basement concrete slab, one sample from a residential roadway, and one sample from the on-site slag field, collected during the July sampling event, to the Richard Smith, Consulting Scientist, Lockheed-Martin Idaho Technologies Co., Idaho National Engineering Laboratory, for visual and microscopic "fingerprinting." Dr. Smith indicated that the offsite samples were "visually indistinguishable" from the on-site slag sample.

Dr. Smith recommended that EPA Region 4 identify other, nearby plants that manufactured elemental phosphorous using the same process (such as the one in Nichols, FL and possibly others). If their source mines, manufacturing processes, and methods for cooling the slag were the same manner as was done at the Stauffer plant, then an in-depth geochemical comparison may be performed to distinguish between their respective slags. However, even a geochemical comparison is not a guarantee.

Conclusion: The materials sampled undoubtedly contain phosphate slag; however, the source has not been definitively determined.

ATSDR PUBLIC HEALTH ASSESSMENT

The ATSDR completed a public health assessment and will distributed it concurrently with EPA's distribution of this fact sheet. In summary, the ATSDR notes that there is a completed exposure pathway to ionizing radiation (radium-226) and heavy metals. However, they do not consider the presence of these contaminants in driveways, roadways, or yards to pose a public health threat. In addition only one home exceeds the recommended screening criteria for indoor gamma radiation. ATSDR recommends:

1) The resident of the one home limit time in the affected areas (primarily the basement).

2) Public health education be provided to assist the public in understanding that slag materials pose no public health hazard.

SUMMARY OF RESULTS

The following summary of results/conclusions can be applied only to the sampling locations evaluated. The sampling locations were "biased," based upon citizen requests and EPA identification of "hot spots."

Phosphate slag is present in the offsite area; however, the origin has not been definitively proven. At least one other plant exists in the area.

Roadways, Driveways, and Yard Soil: Gamma radiation doses, and radiological and non-radiological contaminant concentrations are elevated above background levels but are within the screening criteria established for this analysis.

Home Interiors: Several homes have shown elevated levels of gamma radiation doses; however, only one home exceeds the recommended criteria.

The ATSDR does not consider the offsite slag to pose a public health threat.

CONCLUSION

Based upon the information evaluated, combined with the surveys and analyses conducted by the FDEP, DOH-BRC, and the ATSDR, EPA has determined that no Superfund action is required in the offsite areas.

The Florida Department of Health is the governing authority over radiation in the state of Florida. They can address any concerns regarding radiation in your area.

SOURCES

State of Florida Administrative Code Section 64E-5.301

State of Florida Administrative Code Section 62-785

"Public Health Assessment, Stauffer Chemical Superfund Site Vicinity Properties, Tarpon Springs and Holiday, Florida," Agency for Toxic Substances and Disease Registry, Division of Health Assessment and consultation, December 1998

"Phosphorous Slag Identification in Construction Materials from the Tarpon Springs Area, Florida" Richard P. Smith, PhD, Lockheed-Martin Idaho Technologies Company, Revision 1, November 1, 1998

"Risk Assessment Guidance for Superfund Volume 1, Human Health Evaluation Manual (Part A), Interim Final," EPA/540/1-89-002, December 1989

"Risk Assessment Guidance for Superfund: Volume 1- Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals), Interim," U.S. EPA Publication 9285.7-01B, December 1991

"Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination," OSWER Directive 9200.4-18, August 1998

Letter dated February 5, 1992 from Robert C. Williams, P.E., Director, Division of Health Assessment and Consultation, to Mr. Charles Walters, Hazardous Waste Management, Agency for Toxic Substances and Disease Registry regarding EPA Region III activities at the Austin Avenue Radiation Sites in Landsdowne, PA

"A Citizen's Guide to Radon (Second Edition), The Guide to Protecting Yourself and Your Family from Radon," EPA Office of Air and Radiation, EPA Document No. 402-K92-001, May 1992

HOW DO I FIND OUT MORE?

EPA maintains an information repository at the Tarpon Springs Public Library which contains important documents about the Stauffer site:

Craig Park Branch
Springs Boulevard
Tarpon Springs, Florida 34689
(813) 942-5613

In addition, if you would like more information or have questions about the Stauffer site, please contact:

John Blanchard
or
Carlean Wakefield
U.S. Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, Georgia 30303

1-(800) 435-9234

United States Environmental Protection Agency
Waste Management Division, SSMB
61 Forsyth Street, SW
Atlanta, Georgia, 30303

Official Business
Penalty for Private Use
$300

INSIDE:
STAUFFER
TARPON SPRINGS
UPDATE

Report

Slag Sampling in Tarpon Springs and Surrounding Counties

By:

U.S. Environmental Protection Agency
Region 4, Waste Management Division
Atlanta, Georgia

JANUARY 12, 1999

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

I. Introduction

The United States Environmental Protection Agency (EPA) Region 4 conducted a survey and sampling of gamma radiation and non-radiological contaminants in the communities around and in Tarpon Springs, Florida from June through August 1998. The survey and sampling were prompted by concerns of the local residents in these areas who felt they were being adversely affected by contaminants distributed from the Stauffer Chemical Company Superfund Site (Site) in Tarpon Springs. The survey, sampling, and subsequent analysis were implemented in coordination with survey, sampling, and analysis activities performed by the Florida Department of Health-Bureau of Radiation control (DOH-BRC), Florida Department of Environmental Protection (FDEP), and the Agency for Toxic Substances and Disease Registry (ATSDR).

The approach of this investigation was to identify radiological and non-radiological contaminants in specified households, driveways, yards, and area roadways. The study included an analysis of the risks imposed by the contaminants and any threats to human health due to the presence of the radiological contaminants.

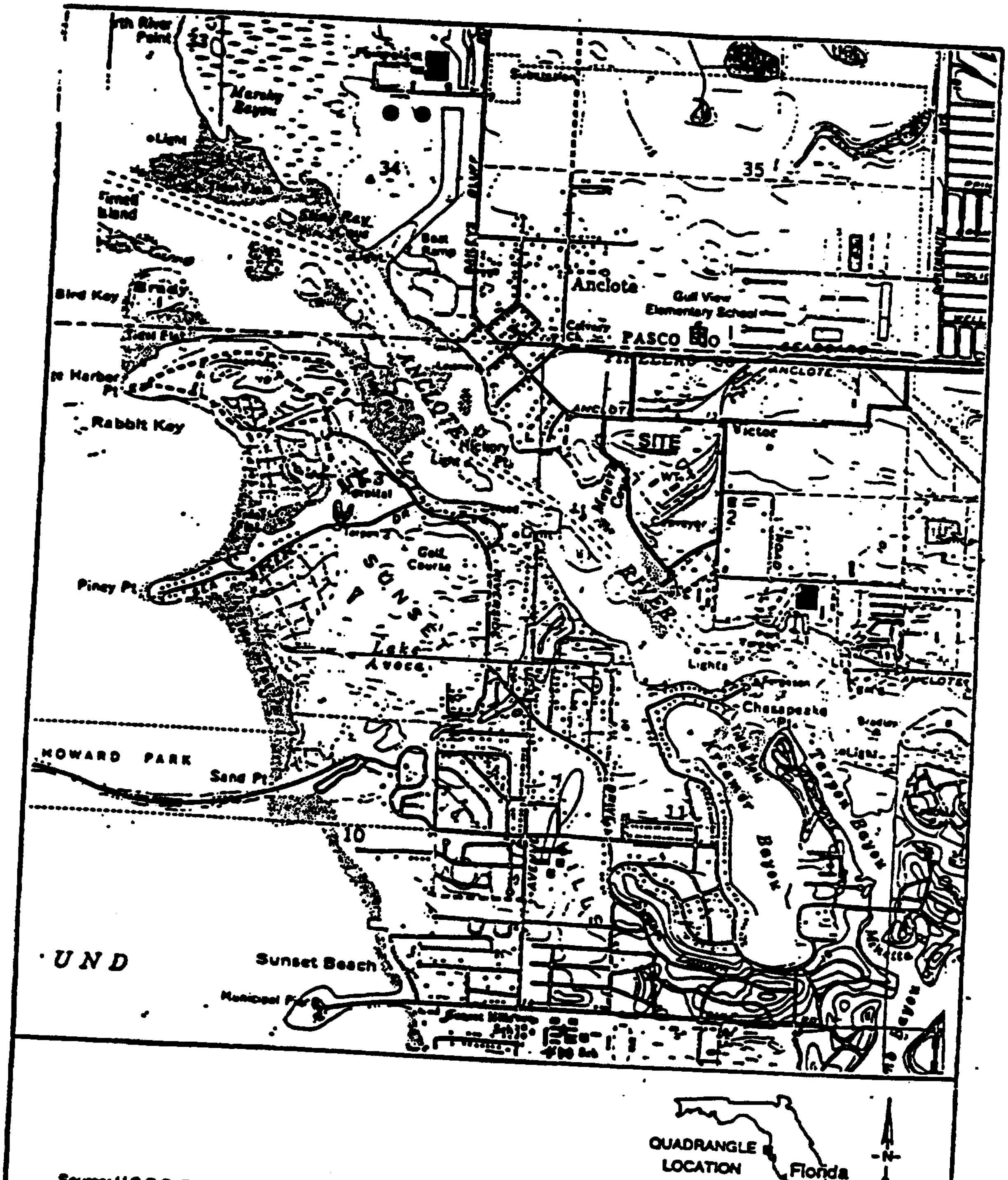
This report describes the chronology, methodology, and results of gamma radiation surveys and invasive sampling activities conducted by the FDEP, DOH-BRC, and EPA Region 4 in the communities surrounding Site. This report also addresses a health consultation developed by ATSDR as well as efforts to microscopically "fingerprint" the slag materials in the community to those found on the Site.

It is important to note that the sampling locations for these investigations were biased in that they were based upon the citizens' concerns and requests. The sampling plan did not represent a scientific or statistical analysis of a truly representative area.

II. Investigation Background

Local residents are concerned that contaminants from the Stauffer Chemical Company operations were distributed and used as building materials in the communities surrounding the Site. The Stauffer Chemical Company and their predecessor produced elemental phosphorous using phosphate ore mined from deposits in Florida. The 130-acre Site is located in Pinellas County near the Pinellas/Pasco County border on Anclote Road. It is situated on the Anclote river, two miles upstream of the Gulf of Mexico and two miles from downtown Tarpon Springs, Florida (see Figure 1). A Remedial Investigation was completed in 1993 and the site was listed on the NPL in 1994. EPA completed the baseline risk assessment in 1994, the Feasibility Study in 1996, and issued the Record of Decision (ROD) to address on-site source contamination in July 1998. Ground water will be addressed under a future ROD.

The primary contaminants of concern within the site boundaries as identified in the ROD are listed in Table 1.



Source: U.S.G.S. Quadrangle, Tarpon Springs, Florida 1973, photorevised 1987

FIGURE 1-1 GEOGRAPHIC LOCATION MAP, SMC TARPON SPRINGS, FLORIDA

Figure 1

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

Table 1 - On-Site Contaminants of Concern

Carcinogens	Carcinogenic PAH's (CPAH's)	Non-Carcinogens
Arsenic	Benzo(a)anthracene	Antimony
Radium-226	Benzo(a)pyrene	Beryllium
	Benzo(b)fluoranthene	Thallium
	Dibenzo(a,h)anthracene	Elemental Phosphorous
	Indeno(1,2,3-cd)pyrene	

A by-product of the elemental phosphorous production process was phosphate slag, which contains Radium-226 and other metallic contaminants of concern listed above. Local residents have expressed concerns that the slag material was transported from the Victor Chemical Works and Stauffer Chemical Company operations and used as construction material in roads, driveways, houses, and other structures in the communities surrounding the Site ("offsite" areas).

In response to these concerns, the DOH-BRC, the FDEP, and EPA Region 4 have sampled and surveyed offsite areas for gamma radiation, heavy metals, volatiles, and semi-volatiles. In addition, EPA Region 4 has obtained information from parties who may have purchased, transported, or used the slag material in offsite areas, or who may have witnessed these activities. EPA Region 4 also obtained a microscopic "fingerprinting" analysis to compare several offsite slag samples with one from the Site. The information collected by EPA Region 4 has verified that slag materials were taken from the Site during its operational years and distributed for use as aggregate in roads, road bedding, and some building materials. The investigations also revealed that a second elemental phosphorous plant in Nichols, Florida distributed slag in a similar manner. The areal extent and contribution of slag distribution from these two plants are unknown. Further, because the use of this type of material for aggregate was accepted as a safe practice at the time it was done, there may have been additional sources of slag material. EPA Region 4 has not formally searched for additional sources of slag.

III. Previous Results - Gamma Radiation Surveys by the DOH-BRC

In response to community requests, DOH-BRC conducted gamma radiation surveys, using a Ludlum Model 12S Micro R Meter (Ludlum Meter), in the following types of locations between July 1997 and January 1998. The results, shown in Table 2, include background levels. "Background levels"are those that would exist in areas not affected by the Superfund site. Average gamma radiation background in Florida is 6 uR/hr.

Table 2 - Summary Results of Gamma Radiation Screening Surveys by DOH-BRC July - December 1997

Location Type	No. Readings	Maximum Gamma Radiation Levels incl. Background (uR/hr)
Non-residential building interiors	5	30
Home interiors	11	80
Driveways	9	120
Roadways	6	100

IV. Previous Results - Heavy Metals Sampling by the FDEP

The State of Florida Department of Environmental Protection (FDEP) collected 10 exterior slag samples in November 1997 and evaluated them for the presence of nine contaminants. The maximum concentrations found for each contaminant, along with the FDEP target soil cleanup levels (current), are shown in Table 3.

Table 3 - Summary Results of Heavy Metals Sampling by FDEP - November 1997 Sampling Event

Contaminant	Maximum Concentration (ppm)	FDEP Soil Cleanup Target Level (ppm)
Arsenic	2	0.8*
Beryllium	1.9	120
Cadmium	0.59	75
Chromium	25.2	290
Fluoride	23	500
Lead	136	500
Mercury	0.017	3.7
Gamma Radiation	6.75 pCi/g in Soil, 120 uR/hr Road	

* This target level was established by FDEP; see Table 6 for EPA interpretation.

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

V. Chronology of Sampling Events - U.S. Environmental Protection Agency, Region 4.

At the request of the community, EPA Region 4 agreed to expand on the DOH-BRC and FDEP activities by conducting additional gamma radiation surveys, and collecting and evaluating additional samples of roads, driveways, yards, and home interiors in Pinellas and Pasco Counties. These activities were conducted from June through August 1998. All sampling was conducted in accordance with the requirements specified in the U.S. EPA, Region 4 Science and Ecosystems Support Division, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM), May 1996. All analytical analyses of the samples were conducted by EPA's National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama. The analysis of contaminants was performed using the methodologies detailed in the U.S. EPA, Office of Solid Waste, Test Methods for Evaluating Solid Waste, SW-846, Third Edition, Update III. Release of all data was approved by the Chief of Analytical Service Branch and the NAREL quality Assurance Coordinator. All QC analyses met NAREL acceptance criteria. Radiation surveys were performed in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), EPA 402-R-97-016, December 1997. The surveys/sampling events were conducted as follows:

June 25, 1998 - Selection of Sampling Locations

EPA conducted a gamma radiation screening survey using a Ludlum Model 19 Micro R scintillation detector (serial number 131320, calibration date 10/21/97), calibrated for Cesium-137 (Ludlum) . The Ludlum meter served as an initial screening/detection tool, providing conservative results when surveying for Radium-226. The survey addressed two home interiors, four driveways, and three roadways. The EPA used the results of the FDOH-BRC surveys and these surveys as screening tools to select future sampling locations. The criterion for selecting sampling locations was the presence of elevated gamma radiation levels.

July 7-10, 1998 - Sampling Event

The U.S. EPA's Science and Ecosystems Support Division, Athens, GA (SESD) collected 26 samples as shown in Figure 2 and Table 4 (plus QA/QC and background samples) and shipped them to EPA's National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama for chemical and radiological analysis. The samples were chemically analyzed for the contaminant groups shown in Table 5. Several samples were also shipped to the Idaho National Engineering Laboratory (INEL) to microscopically compare ("fingerprint") them to the slag material on the Stauffer site. The analytical results were screened for those contaminants of concern in the ROD and contaminants identified while evaluating an on-site slag roadway sample during the on-site remedial investigation. The contaminants evaluated are discussed in the results section below. See Appendix A for detailed results of each sample evaluated under this event. Several additional gamma radiation surveys were conducted during this event.

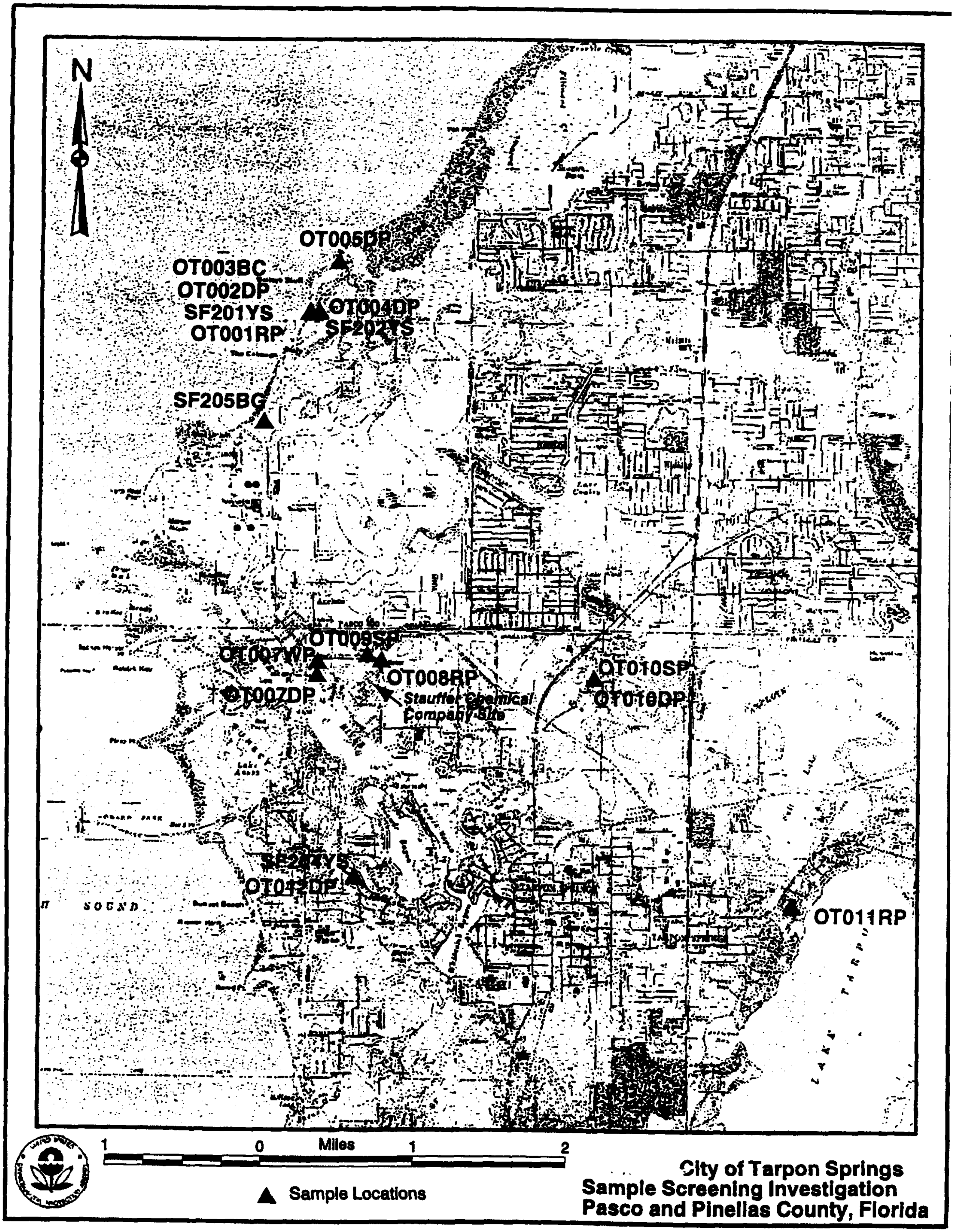

N
OT005DP
OT003BC
OT002DP
SF201YS
OT001RP
OT004DP
SF202YS
SF205BG
OT009SP
OT007WP
OT007DP
OT008RP
Stauffer Chemical
Company Site
OT010SP
OT010DP
OT012DP
OT011RP
1
0
Miles
1
2
▲ Sample Locations
City of Tarpon Springs
Sample Screening Investigation
Pasco and Pinellas County, Florida

Figure 2

Table 4 - Sampling Locations, U.S. EPA Region 4, Week of July 6, 1998

Media	Number of Samples Collected	Number Fingerprinted
Driveway Paving	4	0
Driveway Base	4	0
Roadway Paving	4	1
Roadway Base	4	0
Yard Soils	4	0
Slag Pile in Yard	1	0
Basement Slab on Grade	1	1
Basement Slab Base	1	0
Right of Way Paving	1	0
Right of Way Base	1	0
Stauffer Slag Field	1	1

Table 5 - Analysis Procedures, U.S. EPA-NAREL, Week of July 1998

Analysis Procedure	No. Analytes Evaluated
Gross Alpha-Beta	2
Inorganics - TAL Metals	23
Organics - TCL Volatiles	35
Organics - Semi Volatiles	64
Gamma -Spec	15

August 23-26, 1998 - Re-Sampling of Homes for Interior Gamma Dose

During the gamma radiation screening surveys conducted by the DOH-BRC and EPA Region 4 (in June 1998), it was determined that four home interiors had dose levels of gamma radiation above exposure levels recommended by 40 CFR Part 192- Uranium Mill Tailings Act (20 uR/hr + background). As mentioned previously, the screening surveys were conducted using the Ludlum Meter, which is an appropriate screening tool because it is calibrated for Cesium-137 and provides a conservative result of 20% or more when surveying areas for radium-226. However, since elevated levels were detected, EPA followed up by using a more accurate instrument to determine the gamma radiation dose levels for those areas which exceeded the screening criteria using Ludlum Meter. The four homes were re-surveyed using a Pressurized Ionization Chamber (PIC) and confirmed with a Bicron Micro Rem Meter (serial number B792W, calibration date August 4, 1998). Both instruments detect all radioactive isotopes, and measure the actual body tissue dose. Static gamma radiation surveys were taken at both the waist level and ground level in various locations within these residences. A comparison between the original Ludlum readings and the subsequent PIC readings is provided later in this report. The Bicron and PIC readings matched. The EPA provided each of the homeowners with radon test kits during this sampling event; the radon levels are below the maximum level of 0.04 WL.

VI. Summary of Results - EPA Region 4:

All samples (slag, road base, surface soils) were evaluated assuming that they were available for direct exposure (incidental ingestion, dermal contact, and inhalation) as if they were surface soil samples. This is a very conservative way to screen (evaluate) the data (particularly in slag) to ensure that there are not any known hazards or risks associated with potential exposures. A general description of the methods for analyzing carcinogenic and non-carcinogenic risks due to the contaminants is provided in Appendix A; A summary of the results is provided here; see Appendix B for the results for each sample location.

Tables 6 and 7 provide the maximum levels detected in the EPA July 1998 sampling event, trigger levels, preliminary remediation goals (PRGs), and the source of the PRGs for each contaminant. Trigger levels are those contaminant levels which would trigger an action for carcinogenic contaminants. If a contaminant concentration exceeds the trigger level, then the contaminant would be remediated down to the level no lower than the PRG (in essence, the EPA selected these PRGs and trigger levels as screening levels for this analysis.) Volatiles were also considered but none were detected during the analysis. Elemental phosphorous was not included in this sampling event for several reasons: 1) There was no visual indication that it is present in the slag materials (visual indication would include smoke or fire); 2) It was vaporized, captured, condensed, and stored under water, in a process not tied to the slag materials. 3) It was not found in the site soils or slag. The PRGs shown in tables 6 and 7 represent an excess lifetime cancer risk of 10^{-6} for carcinogens and a hazard quotient = 1 for non-carcinogens.

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

A. Carcinogens, Including Radionuclide Concentrations

Table 6 - Carcinogens Detected in Offsite Sampling - Maximum Contaminant Levels versus Trigger/Screening and PRG Levels

Contaminant	Maximum Level Detected (ppm)	10^{-4} Trigger (ppm)	10^{-6} PRG (ppm)	Source
Arsenic	4.35	40	21	See footnote
Benzo(a)anthracene	U	140	1.4	FAC
Benzo(a)pyrene	U	10	0.1	FAC
Benzo(b)fluoranthene	U	140	1.4	FAC
Dibenzo(a,h)anthracene	U	10	0.1	FAC
Indeno(1,2,3-cd)pyrene	U	150	1.5	FAC
Radium-226 Ingest.	70.2 pCi/g	268	2.68	EPA Risk
Radium-226 Inhalation	70.2 pCi/g	4807600	48076	EPA Risk

EPA Region 4 regulates arsenic in soil as a systemic toxicant with a reference dose of 0.0003 mg/kg/day. The safe soil level for residential use that would not exceed this RfD for a child was determined to be 21 mg/kg (ppm). EPA also considers arsenic to be a carcinogen in the form that may occur in drinking water and has included an oral slope factor in its IRIS database. The application of the slope factor here, though not considered appropriate, would yield a calculated safe soil level for a child at the most protective 10-6 risk level of 0.46 mg/kg. To be additionally conservative, a value of 0.4 mg/kg was used in the preliminary risk evaluations for this sampling event.

U = Below the detection limit FAC = Florida Administrative Code

pCi/g = Picocuries per Gram

Carcinogenic Risk - Based upon analysis of carcinogens at individual sample locations.

Results

The total excess lifetime cancer risk did not exceed 10^{-4} for any of the samples evaluated. No carcinogenic PAH's were detected above the detection limits.

The highest excess lifetime cancer risk calculated was: 2.19×10^{-5}

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

B. Non-Carcinogens:

Table 7 - Non-Carcinogens Detected in Offsite Sampling - EPA, July 1998

Contaminant	Maximum Level (ppm)	HQ = 1 PRG/Screen	Source*
Aluminum	11900	72000	FAC
Antimony	0.298	26	FAC
Arsenic*	4.85	21	EPA Reg 9
Barium**	136	5200	EPA Reg 9
Beryllium	1.92	120	FAC
Cadmium	1.82	75	FAC
Chromium	49.6	290	FAC
Cobalt	7.55	4700	FAC
Copper**	54.8	2800	EPA Reg 9
Iron	3500	23000	FAC
Lead	48	400	EPA
Manganese	187	1500	FAC
Mercury	0.0369	3.7	FAC
Nickel**	34.4	1500	EPA Reg 9
Selenium	2	390	FAC
Silver	0.222	390	FAC
Thallium*	0.7	6	EPA Reg 9
Vanadium**	36.6	520	EPA Reg 9
Fluoride**, ***	1300	3900	EPA Reg 9
Zinc	100	23000	FAC

* The FAC does not provide a PRG for evaluating non-carcinogenic effects of Arsenic or for Thallium; in this case EPA Region 9's risk based number was used.

** The FAC PRGs for these chemical are based on a on-time exposure to a high level (pica behavior) of ingested soil (acute exposure). EPA PRGs are based on long-term exposure to a typical level of incidentally ingested soil (chronic exposure). EPA believes the latter exposure scenario represents the appropriate basis for developing soil clean up levels.

*** Samples not evaluated for fluoride. Sample value shown was that taken from on-site slag roads.

2. Non-Carcinogenic Hazard - based upon analysis of non-carcinogens at individual sample locations.

None of the samples exceeded the Superfund threshold Hazard Index (HI) =1 for target organs. The total Hazard Index for non-carcinogenic contaminants did exceed 1 at one offsite roadway sample location. The results at this location were:

HI road paving = 1.34 HI road base = 1.20

However, the HI for any given target organ did not exceed 1 for either sample.

C. Gamma Radiation Dose Surveys - Residential Properties

Gamma radiation dose levels - residential interiors and driveways. Gamma dose levels for roadways are discussed in conjunction with the DOH-BRC results in Section VII of this report. Applicable guidelines for evaluating risks posed by gamma radiation dose are discussed in more detail in sections VIII and XII below.

Table 8 - Home Interiors Exceeding Screening Levels with Ludlum Meter followed up by EPA Region 4 with PIC. Levels shown at waist level, including background.

Residence	Room(s) Surveyed	Ludlum Meter Screening (uR/hr)	PIC Measurement (uR/hr)
1	Basement	80	40
1	First Floor	20-30	17
2	Master Bedroom	35-40	24
3	Living Room	30-40	20
4	Garage/Tool Shop	60	23

Table 9 - Driveway Locations -Gamma Radiation Doses and Concentrations EPA, July 1998

Driveway Location	1	2	3	4	5
Gamma Level (uR/hr)	45*	40	23.1*	180	140
Radionuclide Concentration (pCi/g)	14.9	39.3	21.8	46.9	55.7

Note: Gamma doses shown were taken at waist level, levels shown include background

* Denotes average - survey taken using PIC- others surveyed using Ludlum meter at single location

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

VII. Summary - Gamma Radiation surveys by DOH-BRC and EPA Region 4

The results of all Gamma Radiation Surveys by DOH-BRC and EPA Region 4 are shown in Tables 8 through 12. Gamma levels shown include background and were obtained using the Ludlum meter at waist level unless otherwise indicated. The highest level of gamma radiation detected over a roadway was 190 uR/hr. Gamma radiation levels in non-residential buildings ranged from background to 30 uR/hr. The highest gamma radiation level detected in a household using the Ludlum meter was 80 uR/hr; the lowest was background. The gamma doses detected in four houses re-surveyed using the PIC ranged from 17 uR/hr to 40 uR/hr. The gamma doses detected on the two driveways surveyed with the PIC were 23.1 uR/hr and 39.4 uR/hr. Driveway dose levels ranged from 20 uR/hr-180 uR/hr when surveyed using the Ludlum meter.

Table 10 - Roadways - EPA Region 4 and DOH-BRC

Roadway Location	1*	2*	3	4	5	6*	7	8*	9*
Gamma Dose (uR/hr)	190	190	100	80	15	180	70	X	X
Gamma Concentration (pCi/g)	69.9	70.2	X	X	X	48.1	X	55.8	45.7

Note: Gamma doses shown were taken at waist level, include background
X Denotes measurement not taken
* Denotes EPA sample location

Table 11 - All Building Interiors Surveyed by FDOH-BRC and EPA Region 4 to date

Building Description	Gamma Level (uR/hr)
6 Residential	Background
Residential	25
Residential	40*
Residential	20*
Residential	23*
Residential	24*
Non-Residential	Background
School	15
School	16
City Hall Basement	25-30
Private Establishment	20

* Denotes locations re-sampled by EPA using PIC

Table 12 - Driveways - EPA Region 4 and DOH-BRC

Driveway Number	1	2	3	4	5	6	7	8	9	10
Gamma Dose (uR/hr)	20	39.4*	50	40	80	180	23.1*	140	125	140
Gamma Concentration (pCi/g)	X	14.9	X	39.3	X	46.9	21.8	55.7	X	X

* Average using PIC - others are spot readings using Ludlum meter

VIII. Available Gamma Radiation Screening Criteria - see table 13 below.

Table 13
Radionuclide Cleanup Criteria, Maximum Levels Detected to Date

Location/Sample Type	**Maximum Gamma Level Detected or Calculated**	**Gamma Radiation Screening Criteria**	**Source**
Indoor Hourly Dose[1]	34 uR/hr	14 uR/hr	FAC
Indoor Hourly Dose[1]	34 uR/hr	20 uR/hr	40 CFR 192
Indoor Annual Dose[2]	205 mRem/yr	100 mRem/yr	FAC/NCRP
Total Property Dose[5]	233 mRem/yr	200 mRem/yr	ATSDR
Roads - Hourly Dose	184 uR/hr	None	
Roads - Annual Dose[3]	129 mRem/yr	500 mRem/yr	FAC/NCRP
Driveways - Hourly ""	174 uR/hr	None	
Driveways - Annual ""[4,5]	122 mRem/yr	200 mRem/yr	ATSDR
Soil Concentration Yards	0.7 pCi/g	5 pCi/g	40 CFR 192
Slag Concentration Roads	70 pCi/g	5 pCi/g	EPA Risk
Slag Conc. Driveways	56 pCi/g	5 pCi/g	EPA Risk

See Appendix A for Radionuclide concentrations for each sampling location. See Appendix C for a graphical representation of available Gamma Radiation Screening Criteria. **Dose Levels shown here do not include background. Concentration levels include background** See Appendix D for annual dose calculations.

[1] Numbers do not include background. Background in Florida averages 6 uR/hr
[2] Assumes 18 hrs/day exposure in home - does not include 6 uR/hr background
[3] Number does not include background, assumes 2 hr/day exposure time
[4] Number does not include background, assumes 2 hr/day exposure time
[5] ATSDR memorandum dated February 5, 1992 from Robert C. Williams, P.E. to Mr. Charles Walters re: Health Consultation for the Austin Avenue Radiation Sites, Landsdowne, PA (January 1992). Recommended relocation of residents if they were exposed to a dose exceeding 500 mrem/yr + background; EPA action for areas exceeding 200 mrem/yr + background; and no EPA action for areas under 200 mrem/yr + background.

XII. Recap of Results

A. Recommended screening triggers/criteria for contaminants evaluated in this analysis:

1. For Heavy Metals and Semi-Volatiles, see tables 6 and 7 above. Triggers are HI >1 for target organ, non carcinogen; Total lifetime excess cancer risk of 10^{-4} for carcinogens.

2. Radionuclides:
   a. Interior of residential homes: 20 uR/hr + background
   b. Whole residential property: 200 mrem/yr + background
      Assume: 18 hrs in home, 2 hrs on driveway.
   c. Whole commercial property: 200 mrem/yr + background
      Assume: 10 hrs in building.
   d. Roadways: Average 500 mrem/yr over length of road, assume 2 hrs/day walking.
   e. Yard soils: 5 pCi/g gamma concentration average over yard area.

B. Comparison of actual sample results to recommended screening levels above:

Table 14 -Number of Sampling Locations Exceeding Screening Levels

Location Type	Contaminant Type	Number Evaluated	Number exceeding screening levels
Home Interiors	Gamma Dose	11	1
Non-Res. Interior	Gamma Dose	5	0
Whole Property	Gamma Dose	6	1
Driveways	Gamma Dose	11	0
Driveways	Metals/Volatiles	4	0
Roadways	Gamma Dose	8	0
Roadways	Metals/Volatiles	5	0
Yard Soils	Gamma Conc.	3	0
Yard Soils	Metals/Volatiles	3	0

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

IX. "Fingerprinting" Offsite Slag Materials

In an attempt to determine the source of the slag in the community surrounding the Site, EPA, during the July 6-10 sampling event, sent core samples from a residential basement, a roadway, and from the on-site slag field to Richard Smith, PhD, at the Idaho National Engineering Laboratory (INEL) in Idaho Falls, Idaho. Dr. Smith, who is employed by Lockheed-Martin Idaho Technologies Company (under contract to EPA's National Environmental Research Laboratory in Las Vegas, Nevada), microscopically compared the samples and concluded that the offsite samples examined were "visually indistinguishable" from the sample taken from the on-site slag field (See Appendix D). Dr. Smith noted, however, that this does not prove that the slag materials originated at the Stauffer site. He recommended that EPA Region 4 determine if any nearby plants manufactured elemental phosphorous using the same process. If so, and if the plants used the same source mines, had similarly sized operations, and cooled the slag materials in the same manner, it may not be possible to distinguish between them. A geophysical chemical comparison of the slags from both plants may then be performed. However, this chemical comparison is not a guarantee.

X. EPA Information Requests.

In conjunction with the "fingerprinting" of slag, EPA distributed letters to local contractors and transporters, requesting information about the shipment and use of slag from the Stauffer Chemical company. Some residents also submitted letters stating their knowledge of this activity. The information obtained is summarized here.

- Numerous residents have witnessed slag being taken from the site and placed at local properties.
- Contractors have purchased slag materials for use as roadway aggregate.
- One railroad company shipped 5-20 car loads of slag from the site during the 1970's and 1980's.
- Several subcontractors involved in purchase of slag were based out of state.
- Mobil Chemical Co. and several predecessors manufactured elemental phosphorous in Nichols, FL, using the same process, and distributing the slag similar to distribution by Stauffer. Victor/Stauffer Chemical Co. and Mobil Chemical Co. distributed slag to the same contractor.
- Initial microscopic fingerprinting is inconclusive regarding the source of the slag materials obtained during the July 1998 sampling event. Further information on other nearby elemental phosporous producers, including the Mobil Chemical operations, microscopic comparison of the Stauffer slag and that produced by other sources, and possibly geochemical comparison of the slag materials is required to determine the source of any slag materials. These evaluations are not guaranteed to be successful .

XIII. Agency for Toxic Substances and Disease Registry (ATSDR) Recommendations

See Appendix E for ATSDR Health Assessment. In summary, the ATSDR does not anticipate any health hazard due to the levels of site related contaminants in the exterior areas. However, the ATSDR does indicate a health hazard in the one home exceeding the 200 mrem/yr + background criteria established in this analysis.

XIV. Conclusions:

This investigation was designed to identify radiological and non-radiological contaminants in specific households, yards, driveways, and roadbeds in and around Tarpon Springs, Florida, and to determine the health threats imposed by the presence of these constituents. While the concentrations of the contaminants evaluated were often higher than background levels, they do not pose an immediate threat to public health in the community.

The data provided in this report shows that the levels of constituents, radiological or non-radiological, found in the roadways, roadbeds, driveways, driveway beds, and yard soils are elevated above background but are not a health concern. Of the nine roadway locations and ten driveway locations surveyed for gamma radiation, none exceeded the recommended dose levels. Of the four roadway locations, four driveways, and four yard soil locations sampled for non-radiological contaminants concentrations, none exceeded the non-carcinogenic or carcinogenic action levels. In fact, in all cases, there were no non-radiological constituents found above EPA Action Levels. Of the 11 residential and five non-residential building interiors surveyed for gamma radiation, one household was above action levels; however, it was below the EPA emergency response threshold of 500 mRem/yr. ATSDR has made recommendations to the homeowner to abate any threat from exposures in that home.

Although some levels were detected above action levels, EPA has determined that further Superfund action is not required. After considering all of the available evidence, this decision was based upon a number of factors.

- All gamma radiation doses detected in homes were below EPA Emergency Response Action levels.
- All doses of gamma radiation measured the outdoor locations were below the screening criteria selected for this analysis.
- Gamma radiation concentrations measured in slag paving are elevated above the 5 pCi/g concentration recommended in 40 CFR 192. However, this concentration was developed for radon-producing, radium-contaminated mill tailings and is not intended to be applied to materials other than soils. Therefore, whole body gamma radiation resulting from radium-226 in slag was evaluated on a dose basis.
- Risk assessment calculations were performed for ingestion and inhalation of radium-226 contaminated slag dust. These calculations showed that inhalation and ingestion of

radium-226 even in the highest concentrations measured are within EPA's screening levels corresponding a 1×10^{-4} excess lifetime cancer risk.

- The slag material has not caused unacceptable levels of Radon-222 in the homes evaluated.
- The concentrations of heavy metals, volatiles, and semi-volatiles in all samples were below EPA screening levels. The cumulative effects were within the acceptable risk range for carcinogens and (with the exception of one sample location) the Hazard Index was less than 1 for non-carcinogens. In that one sample location, the Hazard Index did not exceed one for any specific target organ.
- ATSDR's findings are that, except for one household, there is not a health threat in the neighborhoods and that measures can be taken by that homeowner to reduce a threat.
- The slag has been used in roads placed under State, County, and possibly Federal contracts. Its distribution and use as a building material was deliberate and carried out over many years.

These factors have led the EPA to determine that no further Superfund action is necessary in this case.

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

APPENDIX A
METHODS OF ANALYSIS
CARCINOGENIC RISK AND NON-CARCINOGENIC HAZARD

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

A. Non-Carcinogenic Hazard/Screening:

Method of Analysis/Screening

The Non-carcinogenic Hazard Based Cleanup Goals (RBCs) provided here correspond to a Hazard Quotient of 1.0. For example, the RBC for antimony is 26 ppm. This means that an antimony concentration of 26 ppm would result in a HQ of 1.0 for antimony.For each contaminant in a sample, the HQ was calculated as follows:

$$HQ = \frac{\text{Sample Concentration}}{\text{RBC}}$$

For example, if the concentration of antimony found in a sample was 10 ppm, then the HQ for antimony in that sample would be:

$$HQ_{antimony} = \frac{10\ \text{ppm}}{26\ \text{ppm}} = 0.384$$

The Hazard Index (HI) for that given sample is the sum of the Hazard Quotients for all of the non-carcinogenic contaminants evaluated for the sample. For example, the HI for a sample number 1 would be calculated as:

$$HI_{sample1} = HQ_{aluminum} + HQ_{arsenic} + HQ_{antimony} + \ldots\ldots + \ldots\ldots + HQ_{zinc}$$

If the HI for a given sample location is greater than 1, then the sample is examined further to determine if the HI exceeds 1 for any target organ (a target organ is the part of the body that is affected by the chemical toxicity studies that served as the basis for establishing the reference dose for the specific chemical - see the next page for a list of chemicals and target organs). This is accomplished by summing the HQs for any contaminants that have the same target organ. If not, then no further action is needed. If so, further Superfund action may be required.

B. Carcinogenic Risk/Screening

Method of Analysis/Screening

The Carcinogenic Risk-Based Cleanup Goal (RBC) for each contaminant corresponds to an excess lifetime cancer risk of 10^{-6} for that contaminant. For example, if the Carcinogenic RBC for a given contaminant is 0.4 ppm, this would mean that a concentration of 0.4 ppm for that contaminant would result in an excess lifetime cancer risk of 10^{-6} (one in one million) for that contaminant.

For each contaminant in a given sample, the excess lifetime cancer risk was calculated as:

$$Risk_{contaminant} = \frac{\text{Sample Concentration}}{\text{Carcinogenic RBC}} \times 10^{-6}$$

For example, if the concentration of the contaminant discussed here was 0.2 ppm, then the excess lifetime cancer risk attributed to that contaminant in that sample:

$$Risk_{contaminant} = ((0.2/0.4)) \times 10^{-6} = 5 \times 10^{-7}$$

The lifetime excess cancer risks for each carcinogen evaluated for a given sample are then totaled to get the total lifetime excess cancer risk for that sample location.

For a given sample location, the total carcinogenic risk is:

$$Risk_{contaminant\ 1} + Risk_{contaminant\ 2} + \ldots = \text{Total excess lifetime cancer risk}$$

If the total excess lifetime cancer risk for that sample exceeds 10^{-4} (one in ten thousand), then this risk would be considered unacceptable and further Superfund action may be required.

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

APPENDIX B - DETAILED SAMPLE RESULTS

Preliminary Risk Analysis'
Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Property No. 1, page 1/2
Date of Analysis: 11/13/98

Sample Concentrations

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	DP Driveway Pyo (ppm)	DP Hazard Quotient HQ	DB Driveway Base (ppm)	DB Hazard Quotient HQ	YS Yard Soils (ppm)	YS Hazard Quotient HQ
Aluminum	Neurotoxin	72000	6320	0.088	216	0.003	720	0.010
Antimony	Blood	26	0.0102	0.0004	0.003	0.000	0.027	0.001
Arsenic	Skin	21	0.612	0.029	0.330	0.016	0.196	0.009
Barium	Blood Pressure	5200	41.5	0.008	2.490	0.000	3.410	0.001
Beryllium	Small Intestine	120	0.493	0.004	0.061	0.001	0.033	0.000
Cadmium	Kidney	75	0.0475	0.001	0.056	0.001	0.233	0.003
Chromium	None	290	13.5	0.047	2.1	0.007	4.9	0.017
Cobalt	None	4700	2.24	0.0005	0.069	0.0000	0.139	0.000
Copper	GI Irritation	2800	15.9	0.006	2.390	0.001	4.050	0.001
Iron	None	23000	3290	0.143	619	0.027	759	0.033
Manganese	Central Nervous System	1500	81.6	0.054	37	0.025	22	0.015
Mercury	Central Nervous System	3.7	0.0343	0.009	0.027	0.007	0.026	0.007
Nickel	Body Weight	1500	17	0.011	1.4	0.001	1.8	0.001
Selenium	Central Nrvs Syst, Skin	390	0.947	0.002	0.022	0.000	0.290	0.001
Silver	Skin	390	0.00141	0.000004	0.035	0.000	0.031	0.000
Thallium	Liver	6	0.0425	0.007	0.007	0.001	0.017	0.003
Vanadium	Respiratory	520	11	0.021	2.4	0.005	5.0	0.010
*Fluoride	Dental	3900	1300	0.333	1300	0.333	1300	0.333
Zinc	Blood	23000	6.92	0.0003	5.0	0.0002	39.9	0.002
Non -Carcinogenic Hazard				**Hazard Index** 0.77		**Hazard Index** 0.43		**Hazard Index** 0.45

Carcinogens		Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	002-DP Driveway Pyo (ppm)	Excess Lifetime Cancer Risk	102-DB Driveway Base (ppm)	Excess Lifetime Cancer Risk	201-YS Road Base	Excess Lifetime Cancer Risk
Arsenic		0.4	0.612	1.53E-006	0.33	8.25E-007	0.196	4.90E-007
Radium-226		2.68	14.9	5.56E-006	2.17	8.10E-007	0.557	2.08E-007
Radium-226		48076	14.9	3.10E-010	2.17	4.51E-011	0.557	1.16E-011
Total Excess Lifetime Cancer Risk				**7.09E-006**		**1.63E-006**		**6.98E-007**

	Cleanup Trigger ppm	002-DP	102-DB	201-YS
Lead	400	1.92	0.81	8.69

Exterior Gamma Dose
Driveway Radium-226 (uR/hr) — 39.4 Waist Level, 50 contact on driveway using PIC, includes Background - See attached for further analysis

Analysis

Non-Carcinogenic Hazard Index <1.0 for all sample locations -	OK
Total Excess Lifetime Cancer Risk < 1 x 10E-4 for all sample locations -	OK
Lead concentrations less than 400 ppm for all sample locations -	OK

Comments
* Fluoride sample concentration number shown is from previous on-site slag sample

Preliminary Risk Analysis
Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Property No. 1, Page 2/2
Date of Analysis: 11/13/98

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	BC Basement Slab (ppm)	BC Hazard Quotient HQ	BB Basement Base (ppm)	BB Hazard Quotient HQ	Source of Cleanup Goals	Background Levels (ppm)
			Sample Concentrations					
Aluminum	Neurotoxin	72000	7555	0.105	850	0.012	FDEP	1730
Antimony	Blood	26	0.00302	0.0001	0.003	0.000	FDEP	0.02
Arsenic	Skin	21	0.00456	0.0002	0.004	0.000	EPA Reg 9	0.15
Barium	Blood Pressure	5200	57.5	0.011	1.810	0.000	EPA Reg 9	3.60
Beryllium	Small Intestine	120	0.678	0.006	0.016	0.000	FDEP	0.05
Cadmium	Kidney	75	0.0417	0.001	0.005	0.000	FDEP	0.10
Chromium	None	290	17.7	0.061	1.09	0.004	FDEP	4.25
Cobalt	None	4700	5.88	0.0013	0.014	0.0000	FDEP	0.30
Copper	GI Irritation	2800	54.8	0.020	1.390	0.000	EPA Reg 9	4.40
Iron	None	23000	3500	0.152	402.00	0.017	FDEP	756.00
Manganese	Central Nervous System	1500	135	0.090	2.11	0.001	FDEP	7.47
Mercury	Central Nervous System	3.7	0.0242	0.007	0.026	0.007	FDEP	0.03
Nickel	Body Weight	1500	22.6	0.015	0.58	0.000	EPA Reg 9	6.87
Selenium	Central Nrvs Syst, Skin	390	0.0213	0.00005	0.690	0.002	FDEP	0.02
Silver	Skin	390	0.00139	0.000004	0.001	0.000	FDEP	0.001
Thallium	Liver	6	0.0341	0.006	0.006	0.001	EPA Reg 9	0.02
Vanadium	Respiratory	520	18.7	0.036	0.71	0.001	EPA Reg 9	9.82
*Fluoride	Dental	3900	1300	0.333	1300	0.333	EPA Reg 9	
Zinc	Blood	23000	58.7	0.003	2.88	0.000	FDEP	5.67
Non -Carcinogenic Hazard				Hazard Index **0.85**		Hazard Index **0.38**		

Carcinogens	Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	003 - BC Basement Slab (ppm)	Excess Lifetime Cancer Risk	103-BB Basement Base (ppm)	Excess Lifetime Cancer Risk	Source of Cleanup Goals	Background Levels (ppm)
Arsenic	0.4	4.56E-003	1.14E-008	0.0044	1.10E-008	EPA Reg 9	0.15 ppm
Inhalation	2.68	33.3	1.24E-005	0.384	1.43E-007	EPA Risk	0.661 pCi/g
Ingestion	48076	33.3	6.93E-010	0.384	7.99E-012	EPA Risk	0.661 pCi/g
Total Excess Lifetime Cancer Risk			**1.24E-005**		**1.54E-007**		

Other	Cleanup Trigger (ppm)	003-BC	103-BB		
Lead	400	1.66	0.567	EPA	2.24 ppm

Interior Gamma Dose
Radium-226 (uR/hr) — 39.1 Waist, 46.2 Contact in Basement Including Background See attached for further results and analysis — 6 uR/hr

Analysis

Non-Carcinogenic Hazard Index < 1.0 for all sample locations -	OK
Total Excess Lifetime Cancer Risk < 1 X 10E-4 for all sample locations -	OK
Lead concentrations less than 400 ppm for all sample locations -	OK
Radon in home < 4 pCi/l	OK
Gamma Radiation Dose in Home above Acceptable Standards	FLAG

Comments
* Fluoride sample concentration number shown is from previous on-site slag sample
Two small children, mother works out of the home
Basement slab on grade and structural first floor constructed of slag.

Preliminary Risk Analysis
Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Property No. 2
Date of Analysis: 11/13/98
1143 Anclote Road, Tarpon Springs

Sample Concentrations

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	DP Driveway Pyo (ppm)	DP Hazard Quotient HQ	DB Driveway Base (ppm)	DB Hazard Quotient HQ	Source of Cleanup Goals	Background Levels (ppm)
Aluminum	Neurotoxicity	72000	9980	0.139	1600	0.022	FDEP	1730
Antimony	Blood	26	0.295	0.0113	0.192	0.0074	FDEP	0.02
Arsenic	Skin	21	0.0983	0.005	0.781	0.037	EPA Reg 9	0.15
Barium	Blood Pressure	5200	89.9	0.017	23.600	0.00454	EPA Reg 9	3.60
Beryllium	Small Intestine	120	1.71	0.014	0.054	0.00045	FDEP	0.05
Cadmium	Kidney	75	0.363	0.005	0.475	0.0063	FDEP	0.10
Chromium	None	290	11.4	0.039	3.1	0.011	FDEP	4.25
Cobalt	None	4700	1.48	0.0003	0.528	0.000112	FDEP	0.30
Copper	GI Irritation	2800	15.5	0.006	13.100	0.005	EPA Reg 9	4.40
Iron	None	23000	1890	0.082	1420	0.062	FDEP	756.00
Manganese	Central Nervous System	1500	109	0.073	251.00	0.167	FDEP	7.47
Mercury	Central Nervous System	3.7	0.0241	0.007	0.037	0.010	FDEP	0.03
Nickel	Body Weight	1500	13.8	0.009	9.00	0.006	EPA Reg 9	6.87
Selenium	Central Nrvs Syst, Skin	390	0.0211	0.000	0.023	0.0001	FDEP	0.02
Silver	Skin	390	0.028	0.000072	0.148	0.000379	FDEP	0.001
Thallium	Liver	6	0.117	0.020	0.058	0.010	EPA Reg 9	0.02
Vanadium	Respiratory	520	18.3	0.035	8.03	0.015	EPA Reg 9	9.82
*Fluoride	Dental	3900	1300	0.333	1300	0.333	EPA Reg 9	
Zinc	Blood	23000	10.6	0.0005	65.30	0.0028	FDEP	5.67
Non -Carcinogenic Hazard				**Hazard Index 0.80**		**Hazard. Index 0.70**		

Carcinogens		Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	007-DP Driveway Pyo (ppm)	Excess Lifetime Cancer Risk	107-DB Driveway Base (ppm)	Excess Lifetime Cancer Risk	Source of Cleanup Goals	Background Levels (ppm)
Arsenic		0.4	0.0983	2.46E-007	0.781	1.95E-006	EPA Reg 9	0.15 ppm
Radium-226	(pCi/g) Ingestion	2.68	46.9	1.75E-005	2.19	8.17E-007	EPA Risk	0.661 pCi/g
Radium-226	(pCi/g) Inhalation	48076	46.9	9.76E-010	2.19	4.56E-011	EPA Risk	0.661 pCi/g
Total Excess Lifetime Cancer Risk				**1.77E-005**		**2.77E-006**		

	Cleanup Trigger (ppm)	007-DP	107-DB		
Lead	400	27.9	18.7	EPA	2.24 ppm

Interior Gamma Dose
Indoor Radium-226 (uR/hr) — 20 uR/hr bedroom, 5 uR/hr remainder using Ludlum Scintillator (includes background) — 6 uR/hr

Exterior Gamma Dose
Driveway Radium-226 (uR/hr) — 180 uR/hr waist; 240 uR/hr contact, using Ludlum Scintillator (includes background) — 6 uR/hr

Analysis

Non-Carcinogenic Hazard Index < 1.0 for all sample locations - OK
Total Excess Lifetime Cancer Risk < 1 x 10E-4 for all sample locations - OK
Lead concentrations less than 400 ppm for all locations - OK
See attached for analysis of interior and exterior gamma dose

Comments
* Fluoride sample concentration number shown is from previous on-site slag sample

Preliminary Risk Analysis
Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Property No. 3
Date of Analysis: 11/13/98

Sample Concentrations

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	DP Driveway Pvg (ppm)	DP Hazard Quotient HQ	DB Driveway Base (ppm)	DB Hazard Quotient HQ	YS Yard Soils (ppm)	YS Hazard Quotient HQ	Sourc Clean Goals
Aluminum	Neurotoxicity	72000	7890	0.110	438	0.006	565	0.008	FDEP
Antimony	Blood	26	0.02	0.0008	0.003	0.0001	0.006	0.0002	FDEP
Arsenic	Skin	21	0.225	0.011	0.005	0.000	0.190	0.009	EPA F
Barium	Blood Pressure	5200	74	0.014	0.992	0.00019	1.540	0.0003	EPA F
Beryllium	Small Intestine	120	1.36	0.011	0.010	0.00009	0.023	0.0002	FDEP
Cadmium	Kidney	75	0.0473	0.001	0.011	0.0001	0.033	0.0004	FDEP
Chromium	None	290	13	0.045	0.8	0.003	1.99	0.007	FDEP
Cobalt	None	4700	1.3	0.0003	0.003	0.000001	0.047	0.000	FDEP
Copper	GI Irritation	2800	17.1	0.006	1.460	0.001	1.630	0.001	EPA F
Iron	None	23000	2360	0.103	306	0.013	463	0.020	FDEP
Manganese	Central Nervous System	1500	115	0.077	2.79	0.002	12.00	0.008	FDEP
Mercury	Central Nervous System	3.7	0.0271	0.007	0.027	0.007	0.027	0.007	FDEP
Nickel	Body Weight	1500	15.8	0.011	1.17	0.001	2.32	0.002	EPA F
Selenium	Central Nrvs Syst, Skin	390	2	0.005	0.043	0.0001	0.021	0.00005	FDEP
Silver	Skin	390	0.00149	0.000004	0.001	0.000004	0.006	0.00002	FDEP
Thallium	Liver	6	0.0781	0.013	0.006	0.001	0.008	0.001	EPA F
Vanadium	Respiratory	520	23.2	0.045	1.32	0.003	3.69	0.007	EPA F
*Fluoride	Dental	3900	1300	0.333	1300	0.333	1300	0.333	EPA F
Zinc	Blood	23000	10.6	0.0005	3.02	0.0001	4.12	0.0002	FDEP
Non -Carcinogenic Hazard				**Hazard Index 0.79**		**Hazard Index 0.37**		**Hazard Index 0.40**	

Carcinogens		Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	004-DP Driveway Pvg (ppm)	Excess Lifetime Cancer Risk	104-DB Driveway Base (ppm)	Excess Lifetime Cancer Risk	202 YS Yard Soils (ppm)	Excess Lifetime Cancer Risk	Sourc Clean Goals
Arsenic		0.4	0.225	5.63E-007	0.005	1.13E-008	0.19	4.75E-007	EPA I
Radium-226	(pCi/g) Ingestion	2.68	58.2	2.17E-005	0.321	1.20E-007	0.678	2.53E-007	EPA I
Radium-226	(pCi/g) Inhalation	48076	58.2	1.21E-009	0.321	6.68E-012	0.678	1.41E-011	EPA I
Total Excess Lifetime Cancer Risk				**2.23E-005**		**1.31E-007**		**7.28E-007**	

	Cleanup Trigger (ppm)	004-DP	104-DB	202 YS	
Lead	400	2.12	0.85	2.89	EPA

Exterior Gamma Dose
Driveway Radium-226 (uR/hr) **140 Waist, 180 Contact Including Background, using Ludlum Scintillator**

Interior Gamma Dose **Background**

Analysis

- Non-Carcinogenic Hazard Index <1.0 for all sample locations - OK
- Total Excess Lifetime Cancer Risk < 1.0 E-4 for all sample locations - OK
- Lead concentrations less than 400 ppm for all locations - OK
- Radon in home < 4 pCi/l - OK
- Exterior Gamma Dose - See attached for Analysis

Comments
* Fluoride sample concentration number shown is from previous on-site slag sample
'Sampled access road along home, sampled yard soil along access road

Preliminary Risk Analysis
Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Residential Property No. 5
Date of Analysis: 11/12/98

Sample Concentrations

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	DP Roadway Pvg (ppm)	DP Hazard Quotient HQ	SP Slag Pile (ppm)	SP Hazard Quotient HQ	Source of Cleanup Goals	Background Levels (ppm)
Aluminum	Neurotoxicity	72000	770	0.011	558	0.008	FDEP	1730
Antimony	Blood	26	0.00756	0.000	0.047	0.002	FDEP	0.02
Arsenic	Skin	21	0.349	0.017	0.829	0.039	EPA Reg 9	0.15
Barium	Blood Pressure	5200	47.4	0.009	44.900	0.009	EPA Reg 9	3.60
Beryllium	Small Intestine	120	0.599	0.005	0.749	0.006	FDEP	0.05
Cadmium	Kidney	75	0.139	0.002	0.125	0.002	FDEP	0.10
Chromium	None	290	13.8	0.048	11.4	0.039	FDEP	4.25
Cobalt	None	4700	2.06	0.0004	7.550	0.0016	FDEP	0.30
Copper	GI Irritation	2800	19.7	0.007	15.400	0.006	EPA Reg 9	4.40
Iron	None	23000	2890	0.126	2250	0.098	FDEP	756.00
Manganese	Central Nervous System	1500	77.1	0.051	79.70	0.053	FDEP	7.47
Mercury	Central Nervous System	3.7	0.0239	0.006	0.028	0.008	FDEP	0.03
Nickel	Body Weight	1500	13.4	0.009	11.9	0.008	EPA Reg 9	6.87
Selenium	Central Nrvs Syst, Skin	390	0.386	0.001	1.790	0.005	FDEP	0.02
Silver	Skin	390	0.00137	0.0000	0.0015	0.000	FDEP	0.001
Thallium	Liver	6	0.0515	0.009	0.007	0.001	EPA Reg 9	0.02
Vanadium	Respiratory	520	12.7	0.024	17.20	0.033	EPA Reg 9	9.82
*Fluoride	Dental	3900	1300	0.333	1300	0.333	EPA Reg 9	
Zinc	Blood	23000	71.8	0.003	13.0	0.001	FDEP	5.67
Non -Carcinogenic Hazard				**Hazard Index 0.66**		**Hazard Index 0.65**		

Carcinogens		Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	010 - DP Driveway Pvg (ppm)	Excess Lifetime Cancer Risk	010-SP Slag Pile (ppm)	Excess Lifetime Cancer Risk	Source of Cleanup Goals	Background Levels (ppm)
Arsenic		0.4	0.349	8.73E-007	0.829	2.07E-006	EPA Reg 9	0.15 ppm
Radium-226	(pCi/g) Ingestion	2.68	21.8	8.13E-006	25.1	9.37E-006	EPA Risk	0.661 pCi/g
Radium-226	(pCi/g) Inhalation	48076	21.8	4.53E-010	25.1	5.22E-010	EPA Risk	0.661 pCi/g
Total Excess Lifetime Cancer Risk				**9.01E-006**		**1.14E-005**		

	Cleanup Trigger (ppm)	010 - DP	010-SP	
Lead	400	4.17	6.63	2.24 ppm

Exterior Gamma Dose
Oudoor Paving Radium-226 (uR/hr) — 23.1 average waist level, 35.1 average contact using PIC, including background — 6 uR/hr

Interior Gamma Dose
Indoor Radium-226 (uR/hr) — 19.8 average in kitchen and living room using PIC waist level; 24.0 average at floor level, includes background — 6 uR/hr

Analysis

Non-Carcinogenic Hazard Index < 1.0 for all sample locations -	OK
Total Excess Lifetime Cancer risk < 1 x 10E-4 for all sample locations -	OK
Lead concentrations less than 400 ppm for all sample locations -	OK
Radon in home < 4 pCi/l	OK

Comments
* Fluoride sample concentration number shown is from previous on-site slag sample
Portion of home constructed over concrete slab on grade; separated by crawl space

Preliminary Risk Analysis

Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Bluff Blvd Roadway
Date of Analysis: 11/13/98

Sample Concentrations

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	001-RP Roadway Pyg (ppm)	001- RP Hazard Quotient HQ	101-RB Road Base (ppm)	101-RP Hazard Quotient HQ	Source of Cleanup Goals	Background Levels (ppm)
Aluminum	Neurotoxicity	72000	10200	0.142	11900	0.165	FDEP	1730
Antimony	Blood	26	0.298	0.011	0.252	0.010	FDEP	0.02
Arsenic	Skin	21	4.85	0.231	3.840	0.183	EPA Reg 9	0.15
Barium	Blood Pressure	5200	118	0.023	89.900	0.017	EPA Reg 9	3.60
Beryllium	Small Intestine	120	1.24	0.010	1.920	0.016	FDEP	0.05
Cadmium	Kidney	75	1.82	0.024	1.510	0.020	FDEP	0.10
Chromium	None	290	27.7	0.096	22.3	0.077	FDEP	4.25
Cobalt	None	4700	0.856	0.0002	0.684	0.0001	FDEP	0.30
Copper	GI Irritation	2800	9.54	0.003	8.350	0.003	EPA Reg 9	4.40
Iron	None	23000	3290	0.143	2600	0.113	FDEP	756.00
Manganese	Central Nervous System	1500	167	0.111	127	0.085	FDEP	7.47
Mercury	Central Nervous System	3.7	0.0305	0.008	0.035	0.009	FDEP	0.03
Nickel	Body Weight	1500	17.6	0.012	14.3	0.010	EPA Reg 9	6.87
Selenium	Central Nrvs Syst, Skin	390	0.899	0.002	0.737	0.002	FDEP	0.02
Silver	Skin	390	0.183	0.0005	0.222	0.001	FDEP	0.001
Thallium	Liver	6	0.7	0.117	0.614	0.102	EPA Reg 9	0.02
Vanadium	Respiratory	520	33.9	0.065	26.3	0.051	EPA Reg 9	9.82
*Fluoride	Dental	3900	1300	0.333	1300	0.333	EPA Reg 9	
Zinc	Blood	23000	100	0.004	88.8	0.004	FDEP	5.67
Non -Carcinogenic Hazard				Hazard Index 1.34		Hazard Index 1.20		

Carcinogens		Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	001 - RP Roadway Pyg (ppm)	Excess Lifetime Cancer Risk	101-RB Road Base	Excess Lifetime Cancer Risk	Source of Cleanup Goals	Background Levels (ppm)
Arsenic		0.4	4.85	1.21E-005	3.84	9.60E-006	EPA Reg 9	0.15 ppm
Radium-226	(pCi/g) Ingestion	2.68	70.2	2.62E-005	62.1	2.32E-005	EPA Risk	0.661 pCi/g
Radium-226	(pCi/g) Inhalation	48076	70.2	1.46E-009	62.1	1.29E-009	EPA Risk	0.661 pCi/g
Total Excess Lifetime Cancer Risk				3.83E-005		3.28E-005		

	Cleanup Trigger (ppm)	001 - RP	101-RB	
Lead	400	18.2	11.7	
Exterior Gamma Dose Radium-226 (uR/hr)	190 waist high, 215 Contact (incl. background) over road using Ludium Scintillation Detector			2.24 ppm

Analysis 6 uR/hr

	FLAG**
Non-Carcinogenic Hazard Index > 1.0 for both sample locations -	
** Non-Carcinogenic Hazard Index does not exceed 1.0 for any target organ -	OK
Total Excess Lifetime Cancer Risk < 1 x 10 E -4 for both sample locations -	OK
Lead concentrations less than 400 ppm for both sample locations -	OK

Comments

* Fluoride sample concentration number shown is from previous on-site slag sample
As noted above, Non-Carcinigenic Hazard Index exceeds 1.0 for both sample locations; however, the HQ does not exceed 1.0 for any given target organ.

Preliminary Risk Analysis
Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Property No. 4
Date of Analysis: 11/13/98

DRAFT DELIBERATIVE WORK PRODUCT DO NOT DISTRIBUTE

Sample Concentrations

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	DP Driveway Pvg (ppm)	DP Hazard Quotient HQ	DB Driveway Base (ppm)	DB Hazard Quotient HQ	YS Yard Soils (ppm)	YS Hazard Quotient HQ	Source c Cleanup Goals
Aluminum	Neurotoxicity	72000	7720	0.107	574	0.008	1210	0.017	FDEP
Antimony	Blood	26	0.00302	0.0001	0.003	0.0001	0.036	0.001	FDEP
Arsenic	Skin	21	0.162	0.0077	0.005	0.0002	0.005	0.0002	EPA Re
Barium	Blood Pressure	5200	53.6	0.0103	1.750	0.0003	8.740	0.002	EPA Re
Beryllium	Small Intestine	120	0.984	0.0082	0.013	0.00011	0.036	0.0003	FDEP
Cadmium	Kidney	75	0.0729	0.0010	0.008	0.0001	0.634	0.008	FDEP
Chromium	None	290	14.7	0.051	0.89	0.003	49.6	0.171	FDEP
Cobalt	None	4700	1.29	0.00027	0.181	0.00004	0.295	0.0001	FDEP
Copper	GI Irritation	2800	28.5	0.010	1.200	0.0004	14.5	0.005	EPA Re
Iron	None	23000	3000	0.130	119	0.005	990	0.043	FDEP
Manganese	Central Nervous System	1500	82.9	0.055	1.13	0.001	28.5	0.019	FDEP
Mercury	Central Nervous System	3.7	0.024	0.006	0.028	0.008	0.027	0.007	FDEP
Nickel	Body Weight	1500	16.4	0.011	0.96	0.001	2.13	0.001	EPA Re
Selenium	Central Nrvs Syst, Skin	390	0.572	0.0015	0.022	0.0001	0.021	0.0001	FDEP
Silver	Skin	390	0.00139	0.000004	0.0014	0.000004	0.198	0.001	FDEP
Thallium	Liver	6	0.0601	0.010	0.0067	0.001	0.0084	0.001	EPA Re
Vanadium	Respiratory	520	20.4	0.039	0.81	0.002	1.88	0.004	EPA Re
*Fluoride	Dental	3900	1300	0.333	1300	0.333	1300	0.333	EPA Re
Zinc	Blood	23000	61.9	0.0027	2.56	0.0001	40.6	0.002	FDEP
Non -Carcinogenic Hazard				**Hazard Index 0.79**		**Hazard Index 0.36**		**Hazard Index 0.62**	

Carcinogens		Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	012-DP Driveway Pvg (ppm)	Excess Lifetime Cancer Risk	112-DB Driveway Base (ppm)	Excess Lifetime Cancer Risk	204-YS Yard Soils (ppm)	Excess Lifetime Cancer Risk	Source c Cleanup Goals
Arsenic		0.4	0.162	4.05E-007	0.471	1.18E-006	0.196	4.90E-007	EPA Re
Radium-226	(pCi/g) Ingestion	2.68	39.3	1.47E-005	0.224	8.36E-008	0.812	3.03E-007	EPA Ris
Radium-226	(pCi/g) Inhalation	48076	39.3	8.17E-010	0.224	4.66E-012	0.812	1.69E-011	EPA Ris
Total Excess Lifetime Cancer Risk				**1.51E-005**		**1.26E-006**		**7.93E-007**	

	Cleanup Trigger (ppm)	012-DP	112-DB	204-YS	
Lead	**400**	**2.21**	**1.02**	**31.8**	**EPA**

Exterior Gamma Dose
Driveway Radium-226 (uR/hr) — 40 uR/hr Waist Level, 50 uR/hr Contact on Driveway using Ludlum Scintillator, including Background

Interior Gamma Dose
Indoor Radium-226 (uR/hr) — 24.2 uR/hr Ave in Master Bedroom waist level using PIC, Including Background

Analysis

Non-Carcinogenic Hazard Index <1.0 for all sample locations -	OK
Total Excess Lifetime Cancer Risk < 1 x 10E-4 for all sample locations -	OK
Lead concentrations less than 400 ppm for all sample locations -	OK
Radon in home < 4 pCi/l	OK
See attached for analysis of interior and exterior gamma doses	

Comments
* Fluoride sample concentration number shown is from previous on-site slag sample
Both parents work outside of the home, small children
Master bedroom addition conducted over slag driveway; crawl space in between

Preliminary Risk Analysis

Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Stauffer Slag Pile
Date of Analysis: 11/12/98
Stauffer Slag Pile

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	Sample Concentrations 009-WP Slag Pile (ppm)	009-WP Hazard Quotient HQ	Source of Cleanup Goals	Background Levels (ppm)
Aluminum	Body Weight	72000	12000	0.167	FDEP	1730
Antimony	Blood	26	0.0197	0.001	FDEP	0.02
Arsenic	Skin	21	0.00463	0.000	EPA Reg 9	0.15
Barium	Blood Pressure	5200	108	0.021	EPA Reg 9	3.60
Beryllium	Small Intestine	120	1.99	0.017	FDEP	0.05
Cadmium	Kidney	75	0.157	0.002	FDEP	0.10
Chromium	None	290	13.9	0.048	FDEP	4.25
Cobalt	None	4700	0.957	0.0002	FDEP	0.30
Copper	GI Irritation	2800	3.16	0.001	EPA Reg 9	4.40
Iron	None	23000	3130	0.136	FDEP	756.00
Manganese	Central Nervous System	1500	471	0.314	FDEP	7.47
Mercury	Central Nervous System	3.7	0.0248	0.007	FDEP	0.03
Nickel	Body Weight	1500	14.8	0.010	EPA Reg 9	6.87
Selenium	Central Nrvs Syst, Skin	390	0.414	0.001	FDEP	0.02
Silver	Heart, Liver, Skin	390	0.00141	0.0000	FDEP	0.001
Thallium	Liver	6	0.47	0.078	EPA Reg 9	0.02
Vanadium	Respiratory	520	28.7	0.055	EPA Reg 9	9.82
*Fluoride	Dental	3900	1300	0.333	EPA Reg 9	
Zinc	Blood	23000	16.9	0.001	FDEP	5.67

Non -Carcinogenic Hazard — Hazard Index 1.19

Carcinogens	Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	009-WP Slag Pile (ppm)	Excess Lifetime Cancer Risk	Source of Cleanup Goals	Background Levels (ppm)
Arsenic	0.4	0.00463	1.16E-008	EPA Reg 9	0.15
Radium-226 (pCi/g) Ingestion	2.68	37	1.38E-005	EPA Risk	0.661 pCi/g
Radium-226 (pCi/g) Inhalation	48076	37	7.70E-010	EPA Risk	0.661 pCi/g
Total Excess Lifetime Cancer Risk			**1.38E-005**		

	Cleanup Trigger (ppm)	009-WP	
Lead	400	1.98	
			0.661 pCi/g
Exterior Gamma Dose			
Radium-226 (uR/hr)	120		

Analysis

Total Non-Carcinogenic Hazard Index Exceeds 1.0	Flag
Non-Carcinogenic Hazard Index does not Exceed 1.0 for any specific target organ	OK
Lead concentrations less than 400 ppm	OK
Exterior gamma dose unacceptable; this location is assumed residential, i.e. it is assumed that a residence would be constructed on top of this material	Flag

Comments

Fluoride sample concentration number shown is from previous on-site slag sample

Preliminary Risk Analysis
Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Anclote Road Right of Way at Curve
Date of Analysis: 11/12/98
Stauffer Curve

Sample Concentrations

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	008-WP Rightofway Pvg (ppm)	008-WP Hazard Quotient HQ	108-RB Rightofway Base (ppm)	108 - RB Hazard Quotient HQ	Source of Cleanup Goals	Background Levels (ppm)
Aluminum	Neurotoxicity	72000	8830	0.123	2040	0.028	FDEP	1730
Antimony	Blood	26	0.0566	0.002	0.009	0.0003	FDEP	0.02
Arsenic	Skin	21	0.907	0.043	0.248	0.0118	EPA Reg 9	0.15
Barium	Blood Pressure	5200	78.1	0.015	136	0.0262	EPA Reg 9	3.60
Beryllium	Small Intestine	120	1	0.008	0.215	0.00179	FDEP	0.05
Cadmium	Kidney	75	0.306	0.004	0.304	0.0041	FDEP	0.10
Chromium	None	290	19.3	0.067	6.9	0.024	FDEP	4.25
Cobalt	None	4700	2.36	0.0005	0.567	0.00012	FDEP	0.30
Copper	GI Irritation	2800	17.8	0.006	2.71	0.0010	EPA Reg 9	4.40
Iron	None	23000	3300	0.143	1150.0	0.050	FDEP	756.00
Manganese	Central Nervous System	1500	127	0.085	63.7	0.042	FDEP	7.47
Mercury	Central Nervous System	3.7	0.0302	0.008	0.028	0.008	FDEP	0.03
Nickel	Body Weight	1500	18.7	0.012	17.6	0.0117	EPA Reg 9	6.87
Selenium	Central Nrvs Syst, Skin	390	0.73	0.002	0.022	0.0001	FDEP	0.02
Silver	Skin	390	0.00323	0.0000	0.0021	0.000005	FDEP	0.001
Thallium	Liver	6	0.0965	0.016	0.0069	0.001	EPA Reg 9	0.02
Vanadium	Respiratory	520	27.4	0.053	11.00	0.021	EPA Reg 9	9.82
*Fluoride	Dental	3900	1300	0.333	1300	0.333	EPA Reg 9	
Zinc	Blood	23000	46.9	0.002	16.30	0.0007	FDEP	5.67
Non -Carcinogenic Hazard				**Hazard Index 0.92**		**Hazard Index 0.57**		

Carcinogens		Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	008-RP Rightofway Pvg (ppm)	Excess Lifetime Cancer Risk	108-RB Rightofway Base (ppm)	Excess Lifetime Cancer Risk	Source of Cleanup Goals	Background Levels (ppm)
Arsenic		0.4	0.907	2.27E-006	0.248	6.20E-007	EPA Reg 9	0.15 ppm
Radium-226	(pCi/g) Ingestion	2.68	45.7	1.71E-005	0.834	3.11E-007	EPA Risk	0.661 pCi/g
Radium-226	(pCi/g) Inhalation	48076	45.7	9.51E-010	0.834	1.73E-011	EPA Risk	0.661 pCi/g
total Excess Lifetime Cancer Risk				**1.93E-005**		**9.31E-007**		

	Cleanup Trigger (ppm)	008-RP	108-RB
Lead	**400**	**8.84**	**5.94**

Exterior Gamma Dose
Radium-226 (uR/hr) Measurement not taken at this location

Analysis

Non-Carcinogenic Hazard Index < 1.0 for both sample locations -	OK
Total Excess Lifetime Cancer Risk < 1 x 10E-4 for both sample locations -	OK
Lead concentrations less than 400 ppm for both sample locations -	OK

Comments
* Fluoride sample concentration number shown is from previous on-site slag sample

Preliminary Risk Analysis
Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Right of Way in front of 1143 Anclote Road
Date of Analysis: 11/12/98

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	Sample Concentrations 006-WP Rightofway Pvg (ppm)	006- WP Hazard Quotient HQ	106-WB Rightofway Base (ppm)	106 - WB Hazard Quotient HQ	Source of Cleanup Goals	Background Levels (ppm)
Aluminum	Neurotoxin	72000	9970	0.138	61.8	0.001	FDEP	1730
Antimony	Blood	26	0.0282	0.001	0.003	0.0001	FDEP	0.02
Arsenic	Skin	21	0.287	0.014	0.0045	0.0002	EPA Reg 9	0.15
Barium	Blood Pressure	5200	105	0.020	0.850	0.0002	EPA Reg 9	3.60
Beryllium	Small Intestine	120	1.13	0.009	0.0036	0.00003	FDEP	0.05
Cadmium	Kidney	75	0.149	0.002	0.014	0.0002	FDEP	0.10
Chromium	None	290	14.7	0.051	0.346	0.001	FDEP	4.25
Cobalt	None	4700	2.35	0.0005	0.206	0.00004	FDEP	0.30
Copper	GI Irritation	2800	14.6	0.005	1.12	0.0004	EPA Reg 9	4.40
Iron	None	23000	1500	0.065	53.4	0.002	FDEP	756.00
Manganese	Central Nervous System	1500	144	0.096	1.31	0.001	FDEP	7.47
Mercury	Central Nervous System	3.7	0.0274	0.007	0.026	0.007	FDEP	0.03
Nickel	Body Weight	1500	16.7	0.011	0.39	0.0003	EPA Reg 9	6.87
Selenium	Central Nrvs Syst, Skin	390	0.963	0.002	0.542	0.001	FDEP	0.02
Silver	Skin	390	0.0121	0.0000	0.0014	0.000004	FDEP	0.001
Thallium	Liver	6	0.0946	0.016	0.0064	0.001	EPA Reg 9	0.02
Vanadium	Respiratory	520	24.2	0.047	0.43	0.001	EPA Reg 9	9.82
*Fluoride	Dental	3900	1300	0.333	1300	0.333	EPA Reg 9	
Zinc	Blood	23000	14.3	0.001	2.87	0.0001	FDEP	5.67
Non -Carcinogenic Hazard				**Hazard Index 0.62**		**Hazard Index 0.35**		

Carcinogens		Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	006-WP Rightofway Pvg (ppm)	Excess Lifetime Cancer Risk	106-WB Rightofway Base (ppm)	Excess Lifetime Cancer Risk	Source of Cleanup Goals	Background Levels (ppm)
Arsenic		0.4	0.287	7.18E-007	0.00451	1.13E-008	EPA Reg 9	0.15 ppm
Radium-226	(pCi/g) Ingestion	2.68	48.1	1.79E-005	0.411	1.53E-007	EPA Risk	0.661 pCi/g
Radium-226	(pCi/g) Inhalation	48076	48.1	1.00E-009	0.411	8.55E-012	EPA Risk	0.661 pCi/g
Total Excess Lifetime Cancer Risk				**1.87E-005**		**1.65E-007**		

	Cleanup Trigger (ppm)	006-WP	106-WB	
Lead	**400**	**1.98**	**0.657**	2.24 ppm

Exterior Gamma Dose

Radium-226 (uR/hr)	180 uR/hr Waist Level, 280 uR/hr Contact using Ludium, including Background	6 uR/hr

Analysis

Non-Carcinogenic Hazard Index < 1.0 for both samples -	OK
Total Exess Lifetime Cancer Risk < 1 x 10E-4 for both samples -	OK
Lead Concentrations less than 400 ppm for both samples -	OK
See attached for analysis of exterior gamma dose	

Comments
* Fluoride sample concentration number shown is from previous on-site slag sample

Preliminary Risk Analysis
Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Gulfview Road
Date of Analysis: 11/13/98

Sample Concentrations

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	005-RP Roadway Pvg (ppm)	005-RP Hazard Quotient HQ	105-RB Road Base (ppm)	105-RB Hazard Quotient HQ	Source of Cleanup Goals	Background Levels (ppm)
Aluminum	Neurotoxicity	72000	8333	0.116	9610	0.133	FDEP	1730
Antimony	Blood	26	0.0523	0.002	0.037	0.001	FDEP	0.02
Arsenic	Skin	21	0.326	0.016	0.060	0.003	EPA Reg 9	0.15
Barium	Blood Pressure	5200	105	0.020	91.000	0.018	EPA Reg 9	3.60
Beryllium	Small Intestine	120	1.65	0.014	1.830	0.015	FDEP	0.05
Cadmium	Kidney	75	0.311	0.004	0.233	0.003	FDEP	0.10
Chromium	None	290	20.3	0.070	20.8	0.072	FDEP	4.25
Cobalt	None	4700	1.89	0.0004	1.260	0.0003	FDEP	0.30
Copper	GI Irritation	2800	12.2	0.004	3.550	0.001	EPA Reg 9	4.40
Iron	None	23000	2490	0.108	2450	0.107	FDEP	756.00
Manganese	Central Nervous System	1500	187	0.125	143	0.095	FDEP	7.47
Mercury	Central Nervous System	3.7	0.0269	0.007	0.030	0.008	FDEP	0.03
Nickel	Body Weight	1500	34.4	0.023	15.2	0.010	EPA Reg 9	6.87
Selenium	Central Nrvs Syst, Skin	390	1.27	0.003	0.262	0.001	FDEP	0.02
Silver	Skin	390	0.0166	0.0000	0.033	0.000	FDEP	0.001
Thallium	Liver	6	0.194	0.032	0.134	0.022	EPA Reg 9	0.02
Vanadium	Respiratory	520	36.6	0.070	36.2	0.070	EPA Reg 9	9.82
*Fluoride	Dental	3900	1300	0.333	1300	0.333	EPA Reg 9	
Zinc	Blood	23000	55.6	0.002	33.4	0.001	FDEP	5.67
Non -Carcinogenic Hazard				**Hazard Index 0.95**		**Hazard Index 0.89**		

Carcinogens		Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	005-RP Roadway Pvg (ppm)	Excess Lifetime Cancer Risk	105-RB Road Base	Excess Lifetime Cancer Risk	Source of Cleanup Goals	Background Levels (ppm)
Arsenic		0.4	0.326	8.15E-007	0.0596	1.49E-007	EPA Reg 9	0.15 ppm
Radium-226	(pCi/g) Ingestion	2.68	69.9	2.61E-005	63.5	2.37E-005	EPA Risk	0.661 pCi/g
Radium-226	(pCi/g) Inhalation	48076	69.9	1.45E-009	63.5	1.32E-009	EPA Risk	0.661 pCi/g
Total Excess Lifetime Cancer Risk				**2.69E-005**		**2.38E-005**		

-	Cleanup Trigger (ppm)	005-RP	105-RB		
Lead	**400**	**46.3**	**2.82**	EPA	2.24 ppm

Exterior Gamma Dose
Radium-226 (uR/hr) 190 uR/hrwaist high waist high road using Ludlum Scintillation Detector including Background 6 uR/hr

Analysis

Non-Carcinogenic Hazard Index <1.0 for both samples - OK
Total Excess Lifetime Cancer Risk < 1 x 10E-4 for both samples - OK
Lead concentrations less than 400 ppm for both samples - OK
See attached for analysis of exterior gamma dose

Comments
* Fluoride sample concentration number shown is from previous on-site slag sample

Preliminary Risk Analysis

Radiation, Heavy Metals, and Semi-Volatile Organics Sampling Results - Tarpon Springs, Florida

Address: Villa Street
Date of Analysis: 11/12/98
Roadway at Villa Street

Non-Carcinogen Compounds	Target Organs	Non-Carcinogen Preliminary Remediatn Goals HQ=1 (ppm)	011-RP Roadway Pvg (ppm)	011-RP Hazard Quotient HQ	111-RB Road Base (ppm)	111-RB Hazard Quotient HQ	Source of Cleanup Goals	Background Levels (ppm)
Aluminum	Neurotoxicity	72000	940	0.013	1170	0.0163	FDEP	1730
Antimony	Blood	26	0.033	0.001	0.007	0.0003	FDEP	0.02
Arsenic	Skin	21	0.449	0.021	0.005	0.0002	EPA Reg 9	0.15
Barium	Blood Pressure	5200	82.9	0.016	1.310	0.0003	EPA Reg 9	3.60
Beryllium	Small Intestine	120	1.5	0.013	0.021	0.0002	FDEP	0.05
Cadmium	Kidney	75	0.465	0.006	0.005	0.0001	FDEP	0.10
Chromium	None	290	15	0.052	1.9	0.0066	FDEP	4.25
Cobalt	None	4700	0.844	0.0002	0.150	0.000032	FDEP	0.30
Copper	GI Irritation	2800	14.3	0.005	0.955	0.0003	EPA Reg 9	4.40
Iron	None	23000	1750	0.076	620	0.0270	FDEP	756.00
Manganese	Central Nervous System	1500	92.2	0.061	1.81	0.0012	FDEP	7.47
Mercury	Central Nervous System	3.7	0.0285	0.008	0.027	0.0074	FDEP	0.03
Nickel	Body Weight	1500	12.7	0.008	0.08	0.0001	EPA Reg 9	6.87
Selenium	Central Nrvs Syst, Skin	390	0.0228	0.000	0.021	0.0001	FDEP	0.02
Silver	Skin	390	0.0658	0.0002	0.001	0.000004	FDEP	0.001
Thallium	Liver	6	0.257	0.043	0.007	0.0011	EPA Reg 9	0.02
Vanadium	Respiratory	520	16.4	0.032	1.6	0.0030	EPA Reg 9	9.82
*Fluoride	Dental	3900	1300	0.333	1300	0.3333	EPA Reg 9	
Zinc	Blood	23000	45.6	0.002	2.7	0.0001	FDEP	5.67
Non -Carcinogenic Hazard				**Hazard Index 0.69**		**Hazard Index 0.40**		

Carcinogens		Carcinogen Preliminary Remediatn Goals Risk= 10(-6) (ppm)	011-RP Roadway Pvg (ppm)	Excess Lifetime Cancer Risk	111-RB Road Base	Excess Lifetime Cancer Risk	Source of Cleanup Goals	Background Levels (ppm)
Arsenic		0.4	0.449	1.12E-006	0.00456	1.14E-008	EPA Reg 9	0.15 ppm
Radium-226	(pCi/g) Ingestion	2.68	55.8	2.08E-005	0.6	2.24E-007	EPA Risk	0.661 pCi/g
Radium-226	(pCi/g) Inhalation	48076	55.8	1.16E-009	0.6	1.25E-011	EPA Risk	0.661 pCi/g
Total Excess Lifetime Cancer Risk				**2.19E-005**		**2.35E-007**		

	Cleanup Trigger (ppm)	011-RP	111-RB	
Lead	**400**	**5.33**	**0.683**	2.24 ppm

Analysis

Non-Carcinogenic Hazard Index < 1.0 for both samples - **OK**
Total Excess Lifetime Cancer Risk < 1 x 10E-4 for both samples - **OK**
Lead concentrations less than 400 ppm for both samples - **OK**

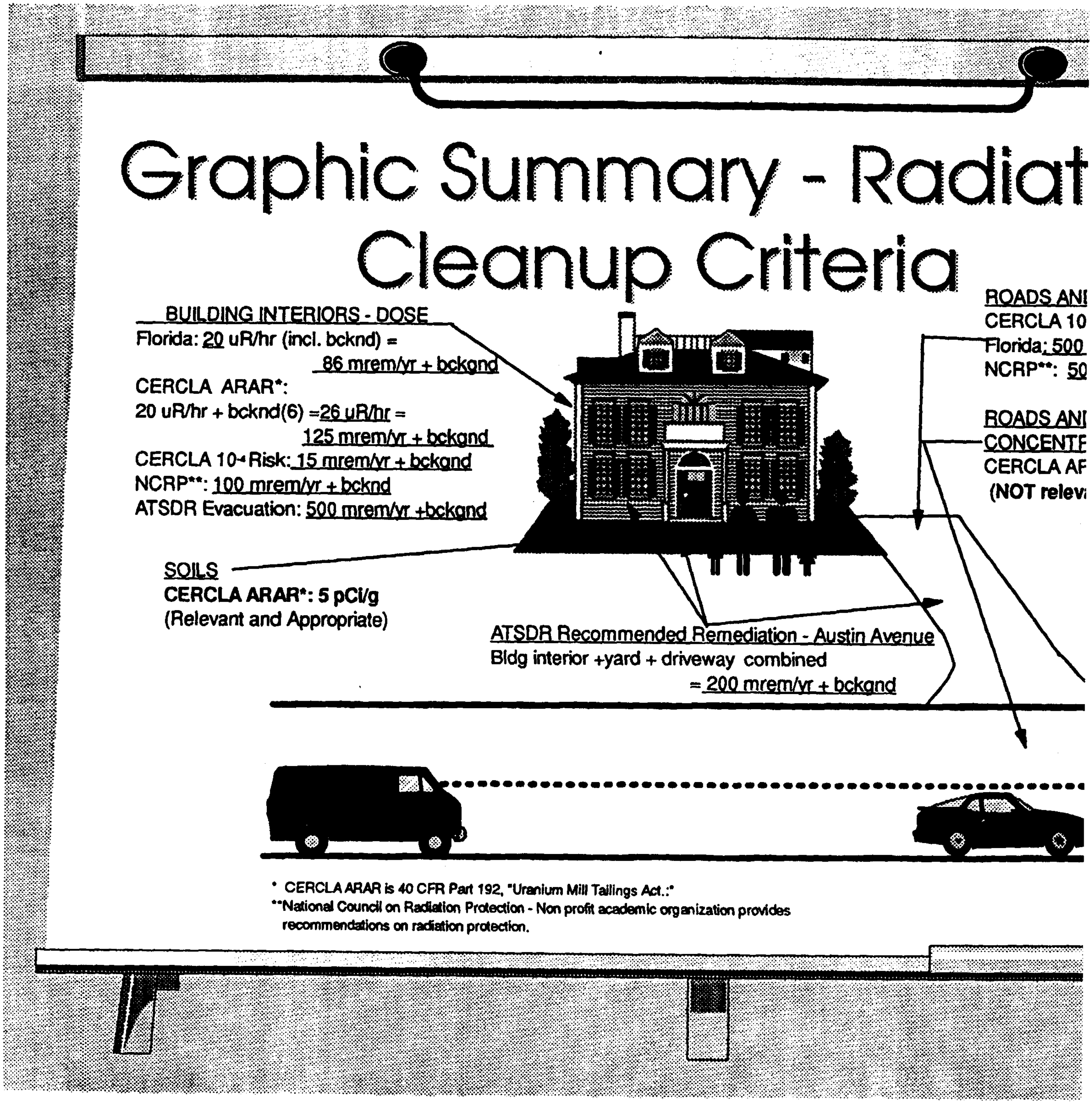
Comments

* Fluoride sample concentration number shown is from previous on-site slag sample

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

APPENDIX C - GRAPHICAL REPRESENTATION - ARARS AND GUIDELINES

RADIONUCLIDES


Graphic Summary - Radiat
Cleanup Criteria
BUILDING INTERIORS - DOSE
Florida: 20 uR/hr (incl. bcknd) =
86 mrem/yr + bckgnd
CERCLA ARAR*:
20 uR/hr + bcknd(6) =26 uR/hr =
125 mrem/yr + bckgnd
CERCLA 10-4 Risk: 15 mrem/yr + bckgnd
NCRP**: 100 mrem/yr + bcknd
ATSDR Evacuation: 500 mrem/yr +bckgnd
SOILS
CERCLA ARAR*: 5 pCi/g
(Relevant and Appropriate)
ATSDR Recommended Remediation - Austin Avenue
Bldg interior +yard + driveway combined
= 200 mrem/yr + bckgnd
ROADS ANI
CERCLA 10
Florida: 500
NCRP**: 50
ROADS ANI
CONCENTF
CERCLA AF
(NOT relev
* CERCLA ARAR is 40 CFR Part 192, "Uranium Mill Tailings Act.:"
**National Council on Radiation Protection - Non profit academic organization provides recommendations on radiation protection.

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

APPENDIX D - MAXIMUM ANNUAL GAMMA DOSE CALCULATIONS

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

Maximum Dose - Home Interior: Property No. 1

Background = 6 uR/hr

Area	Ave PIC Dose (uR/hr)	Dose-Background (uR/hr)	Daily Exposure (hr)	Annual Dose (mrem/yr)
Basement Bedroom	35	35-6 = 29	12	127
Basement Rec Room	44	44-6 = 39	5	71
First Floor	26	26-6 = 20	2	7

Maximum Total Annual Dose: Property No. 1 **205**

Total Property: Again, Property No. 1 is Maximum Dose - Add Driveway Dose

Area	Ave PIC Dose (uR/hr)	Dose-Background (uR/hr)	Daily Exposure (hr)	Annual Dose (mrem/yr)
Driveway	45	45-6 = 39	2	**28**

Total Annual Dose Property = 205 +28 mrem/yr = **233 mrem/yr**

Maximum Annual Dose: Roadway

Total Hourly Dose (uR/hr)	Hourly Dose - Background (uR/hr)	Exposure Time (hr)	Annual Exposure (mrem/yr)
190	190-6 = 184	2	**129**

Maximum Annual Dose: Driveway

Total Hourly Dose (uR/hr)	Hourly Dose - Background (uR/hr)	Exposure Time (hr)	Annual Exposure (mrem/yr)
180	180-6 = 174	2	**122**

SLAG SAMPLING IN TARPON SPRINGS AND SURROUNDING COUNTIES

APPENDIX E - VISUAL FINGERPRINTING

Phosphorous Slag Identification in Construction Materials from the Tarpon Springs Area, Florida

Richard P. Smith, Ph.D.
Consulting Scientist, Integrated Earth Sciences
Lockheed-Martin Idaho Technologies Company
Idaho National Engineering and Environmental Laboratory

Background

EPA Region 4 is evaluating concerns about the health effects of elemental phosphorous slags suspected to be present as construction materials in roads, driveways, and foundations in the communities surrounding the Stauffer Management Company site, Tarpon Springs, Florida. From 1947 until 1981 Stauffer Chemical Company operated an elemental phosphorous plant at Tarpon Springs, and slag from that operation may have been distributed locally for aggregate in construction materials (concrete, asphalt) and possibly for backfill material. In July 1998, EPA Region 4 collected core samples of road paving, soils, driveway materials, and a concrete basement slab-on-grade within the communities surrounding the former Stauffer Chemical Company Plant (a Superfund site). EPA also collected a sample of known slag from the Superfund site as well. The purpose of the sampling was to compare the suspected slag materials from "offsite" areas with the slag found on the Stauffer Management Company site. This report describes the visual macroscopic and microscopic characteristics of slags from construction materials in the area and from the former Stauffer elemental phosphorous plant.

General Description of Samples Examined

The three samples examined for this investigation are described below.

- Sample number OT-009-SP, a drill core of material from a former slag processing area at the Stauffer Management Company site. The sample consists of crushed slag that also contains sand-sized grains of material that effervesces in dilute hydrochloric acid. This material is probably carbonate sand composed either of limestone fragments or coral reef fragments. The sample also contains a substance that is "sticky" and imparts cohesion to the particles. Slag fragments are estimated to make up more that 50% of this material in the sample and range in size from about 1mm (sand size) to several centimeters across. This sample is probably more representative of the complete range of slag characteristics produced at the former plant than a single sample of slag from a primary slag pile. This is because the sample contains slag fragments which exhibit a wide range of textures, colors, and lusters.
- Sample number OT-003-BC, a drill core of concrete from the basement floor of a home in Holiday, Florida. Slag fragments are readily identified, both with and without magnification, in this sample and are estimated to make up 40 to 50% of the total sample volume. Slag fragments make up most of the aggregate mixed with cement to make the concrete; some fragments of natural rock are also present.
- Sample number OT-001-RP, a sample of asphalt pavement from a street in Holiday, Florida. This sample contains fragments of slag and natural rock materials in an asphalt matrix. The sample is small, and only a few slag fragments were recovered for examination. Since the asphalt coats the fragments, they had to be removed from the matrix and individually broken to reveal fresh surfaces for examination.

Description of Optical Characteristics of Slags

The optical characteristics of slag fragments in three samples were determined by direct visual observation and by use of a binocular microscope. All three samples contain a very similar suite of vitreous, microcrystalline, angular, vesicular fragments. They range in size from about 1 millimeter or less up to several centimeters. Their vesicularity and glassy luster make the large fragments easy to identify, even without magnification. Some of the smaller fragments require magnification (either hand lens or binocular microscope) for identification. Fragment shapes are typically angular and irregular.

The slag fragments exhibit a wide range of colors, including white, gray, tan, brown, blue, and rarely, green. The degree of vesicularity ranges from scoriaceous (Figure 1, vesicles so abundant that the material is mostly made of thin bubble walls) to non-vesicular (Figure 2). Some fragments appear to be completely glassy, but high magnification usually reveals abundant microlites (microscopic crystals). The light-transmission characteristics of the slags ranges from opaque through translucent to almost transparent.

Microlites occur in slender blade-like forms that commonly are grouped into bundles. The microlites range in length from less than 1 mm to over 2 mm. Microlites in dark blue and dark gray fragments commonly have light-colored margins and therefore stand out prominently (Figures 3 and 4). Others are prominent because they have a deeper color than the matrix in which they occur (Figures 5 and 6). When they occur in strongly vesicular fragments, which is common, microlites often form the bubble walls between vesicles (Figure 7) and in some cases cause the vesicles to take on a boxwork appearance (Figure 8). Some slag fragments appear to be completely crystalline, and in these cases the vesicle voids are forced to take on the tabular shapes of the openings between individual crystals (Figure 9).

Slag Characteristics in Individual Samples

Sample OT-009-SP (Stauffer Management Company site). Slag fragments in this sample exhibit the widest range of sizes, colors and textures observed in any of the samples. Sizes down to sand-size grains are clearly recognized in the sandy matrix (Figures 10) and many fragments are several cm across. Green fragments are rarely observed in this sample (Figure 11), whereas green fragments have not been seen in the other two samples. The Stauffer sample contains the full suite of textures observed in all samples ranging from prominent microlites to glassy-looking luster, from scoriaceous to non-vesicular, and from deeply colored to clear and transparent.

Sample OT-003-BC (Concrete in a Basement Floor). Because numerous fragments are available for examination in this sample, it contains almost as varied a suite of textures and colors as the sample from the Stauffer Management Company site. Notably, it contains fragments with some of the best examples of prominent microlites of any of the samples (Figure 12).

Sample OT-001-RP (Asphalt Pavement). Since only a few fragments were recovered for examination, the range of characteristics is not as varied as the other two samples. Even so, scoriaceous (Figures 13 and 14), only moderately-vesicular (Figure 15), and microlite-rich (Figure 16) textures are found. In most cases, asphalt can be seen coating portions of the fragments (Figures 13, 14, and 16).

Information Pertinent to Identification of The Source of Slags in Construction Materials.

The slag fragments in the concrete and asphalt samples are very similar to the fragments in the sample from the Stauffer Management Company site (See the Appendix for a photographic comparison of slag textures).

- All three samples contain a very similar suite of vitreous, microcrystalline, variably vesicular, angular fragments of slag.
- Similar ranges of color and opacity occur in all samples.
- The sizes, shapes, and groupings of microlites in all samples are indistinguishable by visual examination.

- All slag textures observed in the construction material samples are also observed in the Stauffer Management Company site sample. In other words, the suite of textures observed in the construction materials are a subset of the suite observed in samples from the Stauffer Management Company site. If the construction material samples were added to the suite from the Stauffer Management Company site, they would be accommodated without having to change the descriptions of the suite from the former plant site.
- At least one other elemental phosphorous plant was in operation in Florida during the time that the Stauffer plant operated in Tarpon Springs. It was called the Electrophosphate Plant, operated by Mobil Chemical Company, and was located in the area near Nichols and Mulberry, about 50 miles east southeast of Tarpon Springs. No slag samples from this former plant have been made available for examination, so comparisons to construction material samples could not be made. However, given the similar source of ore and potentially similar processing methods, it is possible that slags from that plant would be very similar to those from the Stauffer Management Company site. If EPA desires to try to discriminate between these two potential sources (and perhaps others) for the slags in construction materials in the Tarpon Springs area, the following sections suggest methods that may be useful for discrimination.

Visual Discrimination Among Slags Produced by Different Elemental Phosphorous Plants

Slags from an elemental phosphorous plant in Soda Springs, Idaho were examined for comparison to the Tarpon Springs slags. The comparison shows that it is possible, in this case, to distinguish between the slags from individual plants based only on visual examination under a binocular microscope. Obviously, many similarities exist between the Tarpon Springs and Soda Springs slags, but the Soda Springs slags are more uniform in color, vesicularity, and microlite distribution. Their color is a uniform light gray, with occasional white fragments. Almost all samples exhibit moderate to strong development of vesicles. Microlites are easily seen in all samples and tend to occur in radiating "rosettes" of lath-shaped forms. In some places, near vesicle walls and cooling surfaces, the microlites are aligned in parallel masses instead of radiating rosettes. Based on these characteristics, it is possible to distinguish between Tarpon Springs and Soda Springs slags.

It is recognized that Idaho phosphate ores are compositionally and texturally different from Florida phosphate ores, and that processing methodologies used today have evolved considerably from those used in Florida before 1981. The purpose of the comparison to the Idaho plant is not to suggest that it would be equally as straightforward to discriminate between two Florida plants. It does show, however, that two plants which process phosphate ore by mixing with silica and coke and wholesale melting in electric arc furnaces can produce slags that are distinguishable visually. The task of discrimination among potential Florida slag sources could be considerably more challenging.

Several factors may have contributed to visual differences of slags from the Idaho and Florida elemental phosphorous plants. These factors include:

1. The ore used by the plant. One of the factors that contribute to the uniformity of the slag produced at the Soda Springs, Idaho plant is the uniform quality of the ore, and efforts made at the plant to blend ores to obtain a uniform furnace feed. If the Florida ores are less uniform in composition and grade, and if no efforts were made to blend for uniform furnace feed, then the slags would be expected to show greater variation in visual characteristics.
2. The level of technology used in the plant. Plants in operation today, such as the Soda Springs, Idaho plant, have much more sophisticated processing techniques and equipment than were available in the days when the Stauffer plant operated at Tarpon Springs. Modern plants are controlled so that conditions remain uniform in all stages of processing. Blending of ores to produce uniform furnace-feed, control of oxidation state and temperature in the furnace, and standardized transport and disposal of molten slag all contribute to uniform slag characteristics.

3. The method of slag disposal after melting in the furnaces. At the Soda Springs plant molten material from the furnaces is transported by rail to the edge of the slag-pile and dumped over the edge. This causes the molten slag to cool and crystallize quickly in thin sheets as it runs down the edge of the pile. If other methods of dumping are used, perhaps dumping in a ponded area so the slag cools slower, or has pockets that cool slower than other pockets, then variable slag characteristics would be expected.

Use of visual examination to discriminate among potential Florida sources is likely to be more difficult, but, because of all the ore deposit and processing variables listed above and in the next section, should be the first method attempted. As an example, slag disposal methods have a good potential to produce different visual characteristics of slags, even among Florida plants. The information available from the former Mobil Electrophosphate Plant indicates that their slags were processed by placing the molten material in a pit and cooling with water. This may have been a common method for all Florida plants, but, on the other hand, it may have been unique to this particular plant. If other plants cooled their slags without water, or without using pits then it is possible that distinct visual differences occur, even though the ores were very similar and all other processing steps were similar.

In any case, the criteria for distinguishing between these slags should not be based upon any one slag characteristic, but on the whole suite of characteristics exhibited. Therefore, in any attempt to identify the source of a particular slag sample with two or more potential sources (plants), a large number of slag particles or fragments should be examined. The characteristics of the suite of textures as a whole, rather than the characteristics of any single fragment, furnishes the best criteria for discrimination.

Even in the best of circumstances, it still may not be possible to discriminate among Florida phosphorous slags by visual examination. In that case the following section is provided to show that at least one other method of discrimination is potentially viable. It could be considerably more expensive and time-consuming than visual examination however, because it would involve chemical analysis of numerous samples and time for analysis of the resulting chemical data.

Slag Source Discrimination Using Slag Composition

Although no compositional information was used in this investigation of visual characteristics of slag, it is likely that standard geochemical methods could be used to discriminate among slags from different sources if visual characteristics were not definitive. This is because the compositions of slags produced by different plants are likely to be different for a number of reasons. The reasons for potential compositional differences among slags produced by different plants include different ore compositions and unique plant characteristics.

Unless two plants use the same mine as feed for their furnaces then it is likely that there will be at least minor differences in ore composition. Even if two or more mines produce ore from the same stratigraphic ore deposit, slight variations in depositional conditions from place to place within a deposit may cause slight compositional differences in the ores. Those differences will potentially be carried through the production process and manifest themselves in the slags.

Each elemental phosphorous plant is unique. There are differences in processing equipment (perhaps furnace size, furnace heating characteristics, calciner size, etc.), in plant technology (e.g. capability for furnace feed control or for oxidation state control in the furnace), in market niche (different levels of purity are needed for different final products), in carbon and silica source (perhaps a silica sand in one plant and crushed quartzite in another), in slag-disposal procedures, in operational philosophy, and in plant vintage (older plants tend to have fewer technological advances than newer ones). All of these, and probably other plant characteristics, have a high potential for affecting the final composition of the slags.

The compositional differences are more likely to be present in minor and trace element contents than in major element contents because most ores used for elemental phosphorous production are similar in major element contents. Elements likely to exhibit differences include Cd, Ti, Mg, Sr, K, Na, F, Ag, Y, Se, Yb, Mo, La, Pb, U, and Zn. Many of these are elements that show elevated levels (with respect to levels in average marine shales) in phosphate ores. Before deciding on a final list of elements for analysis, it would also be important to closely examine the processing steps in the potential source plants in order to identify any steps unique to one plant or another that would be likely to cause differing geochemical signatures in the final slags.

A standard geochemical investigation approach is likely to provide discrimination criteria. In this approach, a "whole-rock" major, minor, and trace element analysis is obtained for a suite of samples from each area of concern (perhaps two potential slag sources and one structure which contains slag of unknown origin). Then various data analysis techniques are used to display the analytical results to reveal subtle difference in compositions of different sample suites. These usually include plotting of elemental contents or ratios of elemental contents against each other. It may be found that the different suites of samples plot in different fields (or areas) on one or more of these plots. If it is found that the slag of unknown source matches the geochemical characteristics of one of the potential sources, then a strong case can be made for assigning the slag to a particular plant.

Conclusions

The visual characteristics of slags present in two samples (one of concrete and one of asphalt) from Holiday, Florida are indistinguishable from a sample of slag from the former elemental phosphorous plant of Stauffer Chemical Company at Tarpon Springs, Florida. The color, opacity, luster, and degree of vesicularity of the slags, and the characteristics of microlites within the Holiday slags, fall within the range of those observed in samples from Stauffer's former plant. This does not prove that the Holiday samples came from the Stauffer Management Company site because at least one other elemental phosphorous plant (near Nichols and Mulberry) was operational in Florida in the same timeframe that the Stauffer plant was operational. Given the similarity of ores and of processing plant vintage, the Nichols plant could also have produced slags with the same characteristics as those seen in the construction materials from Holiday. But it is also possible that slags from the two former plants (and any others that may come to light in the future) can be distinguished based on visual and/or compositional characteristics.

List of Figures

Scale of Figures

The scale bar in the photographs is 10mm long. All photographs without a scale bar have a 5mm field of view (measured in long dimension of the photograph) with one exception. The photograph in Figure 12 has a 1cm field of view measured in long dimension.

Main Report Figures

Appendix Figures

Appendix
Photographic Comparison of Textures of Slag Fragments

The purpose of this appendix is to help the reader to compare slag textures from the two "offsite" samples (OT-001-RP and OT-003-BC) to the textures exhibited by the sample from the Stauffer Management Company site (OT-009-SP). It is organized into three parts, one for each of the offsite samples and one for the Stauffer Management Company site sample. It makes use of the photographs shown in Figures 1-16 of the main report, and supplements those with additional photographs in appendix figures. The appendix figures are numbered using the following system: RP = road pavement sample; BC = basement concrete sample; and SP = Stauffer Management Company site sample. For each of the offsite slag textures depicted in photographs, short descriptive statements direct the readers' attention to photographs of similar textures in the Stauffer Management Company site sample.

Part 1. Road Pavement (RP) Slag Textures [Sample OT-001-RP].

White scoriaceous (highly vesicular) fragments from this sample are shown in Figures 13, 14, and 16 of the main report and in Figure RP-1. These should be compared to similar textures seen in Figure 1 of the main report and to Figures SP-1 through SP-5 of this appendix.

Bluish and grayish, slightly to moderately vesicular textures shown in Figures 14 and 15 of the main report should be compared to similar textures from the Stauffer Management Company site shown in Figures 2, 6, and 7 of the main report and to Figure SP-6 of this appendix.

Microlite textures shown in Figure 16 of the main report should be compared to those shown in Figure 4 and to appendix Figures SP-7 and SP-8.

Part 2. Basement Concrete (BC) Slag Textures [Sample OT-003-BC]

White, gray, and blue vesicular fragments seen in appendix Figures BC-1 through BC-3 should be compared to textures from the Stauffer Management Company site seen in Figure 1 and in Figures SP-1 through SP-6 of this appendix.

Blue vesicular fragments depicted in Figure BC-4 should be compared to the Stauffer Management Company site texture seen in Figure SP-6.

Microlite textures shown in Figures 3 and 12 should be compared to the Stauffer Management Company site textures seen in Figure 4 and Figures SP-7 and SP-8.

Part 3. Stauffer Management Company site (SP) Slag Textures [Sample OT-009-SP]

The white, tan, brown, gray, and blue vesicular slag textures shown in Figure 1 and Figures SP-1 through SP-6 are seen in both of the offsite samples. Compare to road pavement textures seen Figures 13 and 16 and Figure RP-1. Also, compare to basement concrete textures seen in Figures BC-1 through BC-4.

Although no large Stauffer Management Company site slag fragments showing prominent microlites were photographed, the small fragments shown in Figure 4 and Figures SP-7 and SP-8 exhibit the same microlite textures as seen in road pavement slag fragments (Figure 16) and in basement concrete slag fragments (Figures 3 and 12).

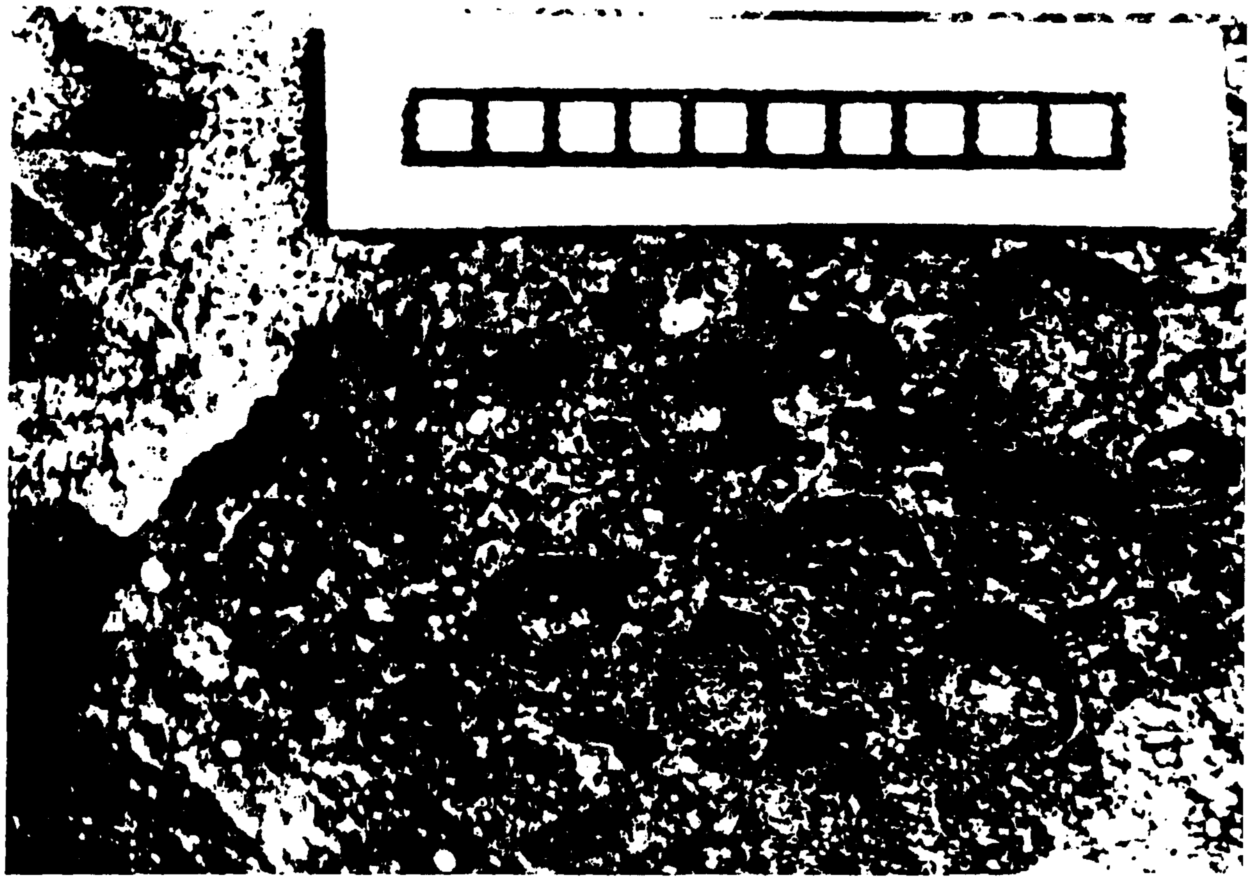


Figure 1. Brown scoriaceous slag fragment from OT-009-SP.

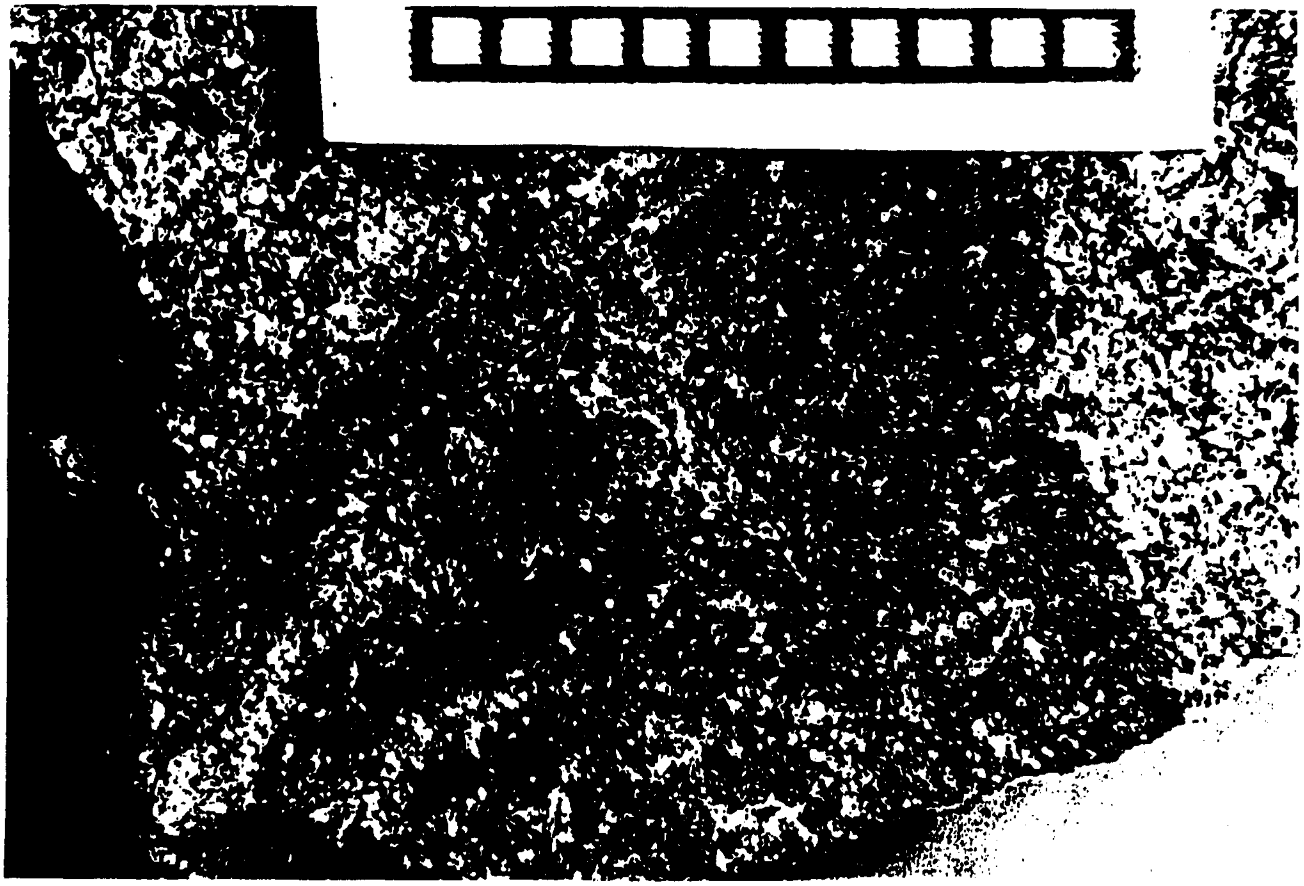


Figure 2. Blue-gray non-vesicular slag fragment from OT-009-SP.

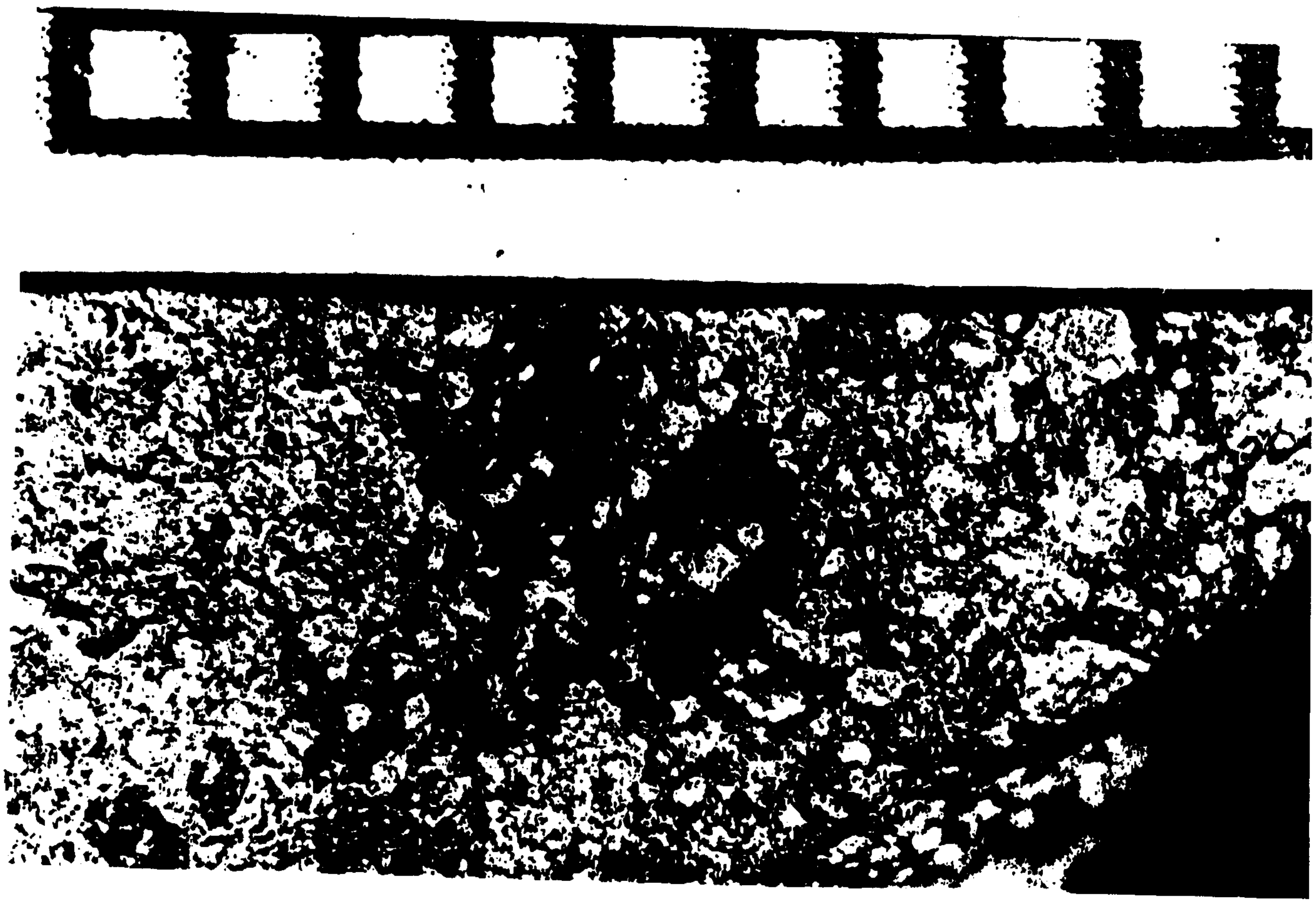


Figure 3. Microlites in gray slag fragments from OT-003-BC.

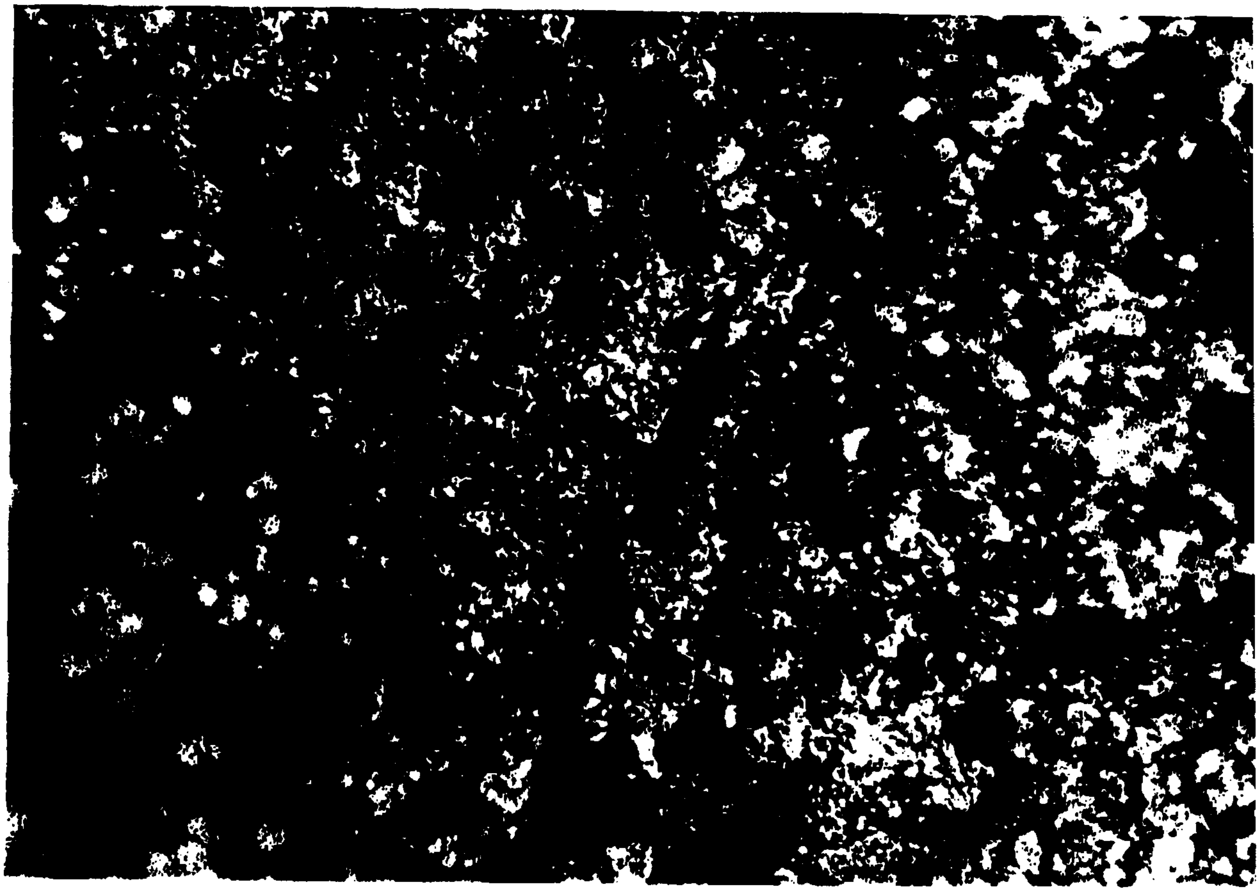


Figure 4. Microlites in sand-sized slag fragment from OT-009-SP.

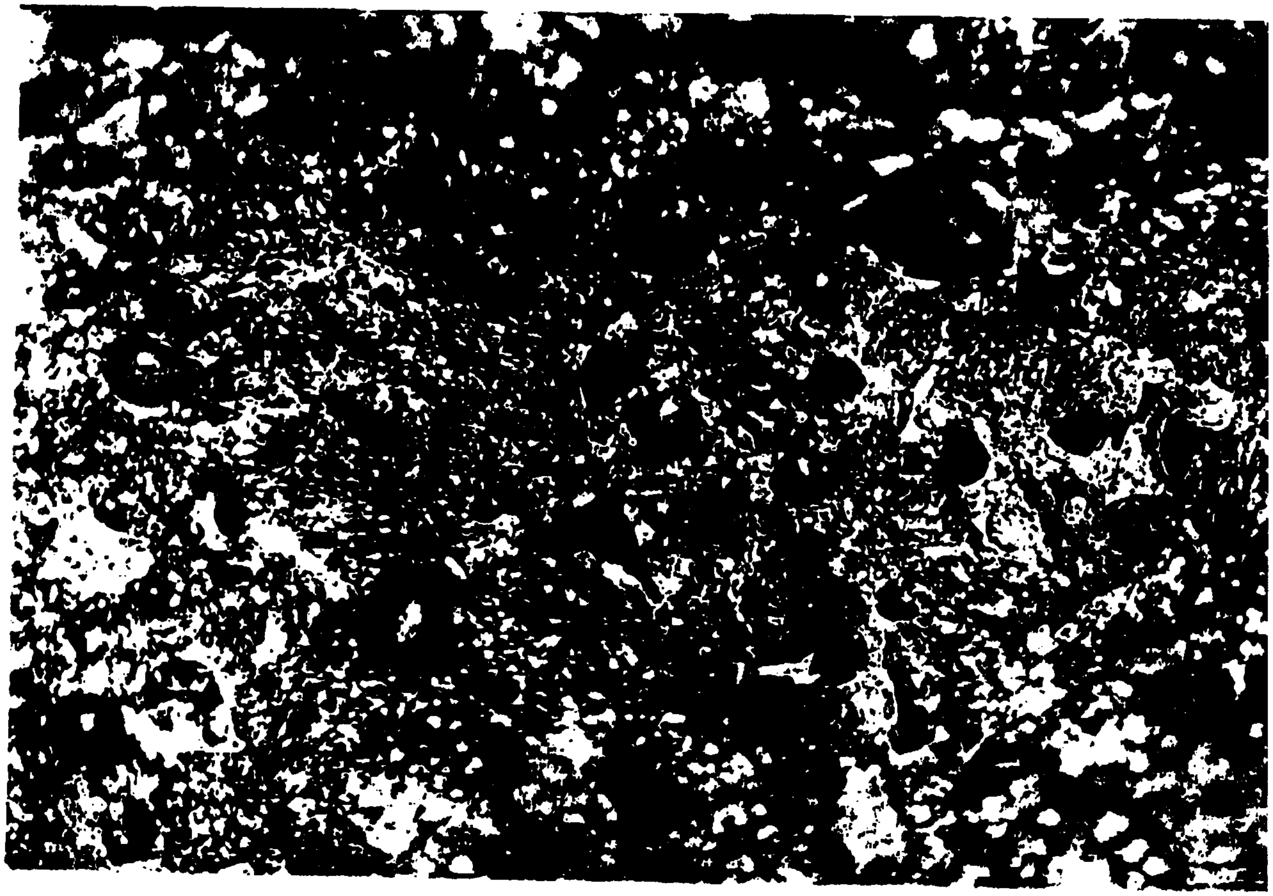


Figure 5. Microlites in brown slag fragment from OT-009-SP.

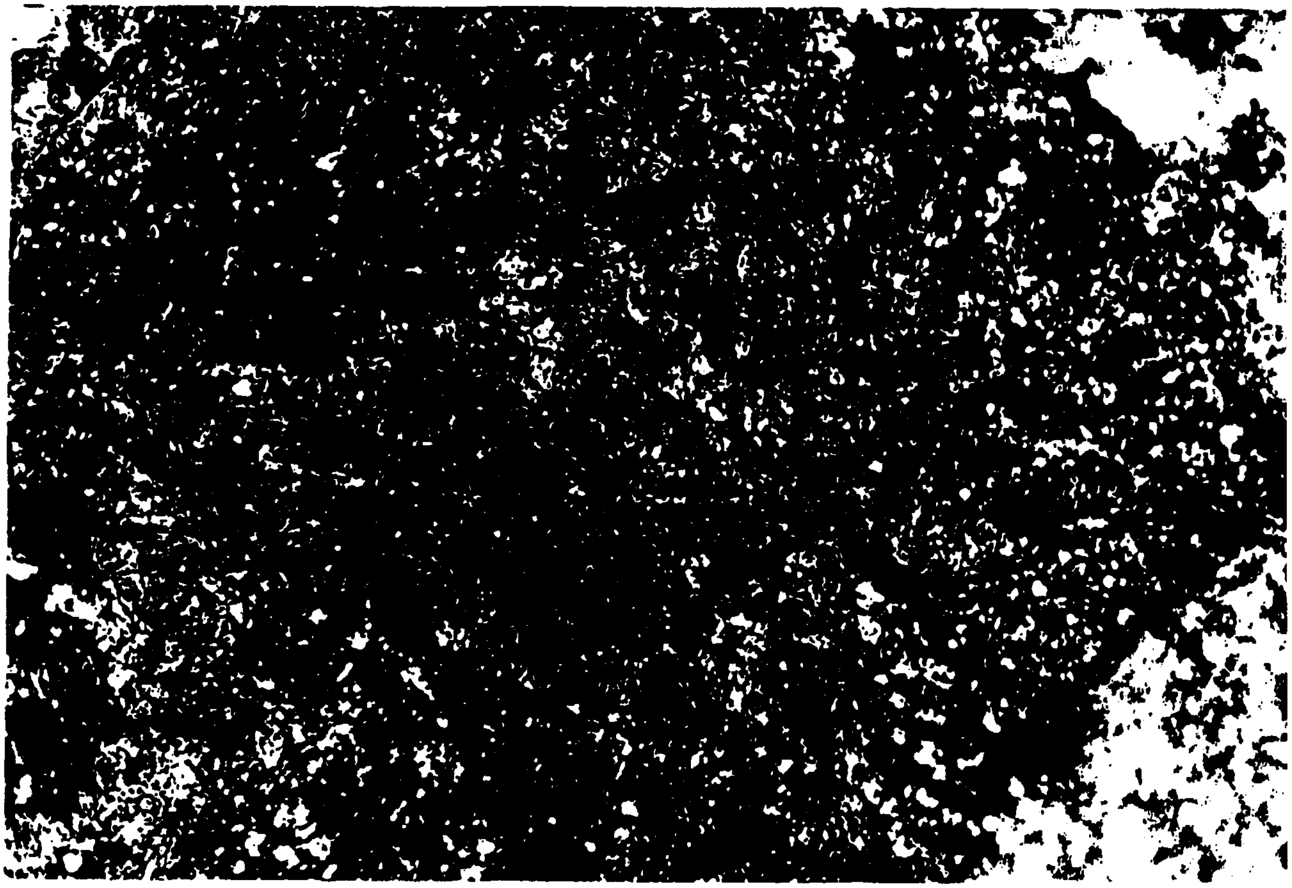


Figure 6. Microlites in blue slag fragment from OT-009-SP.

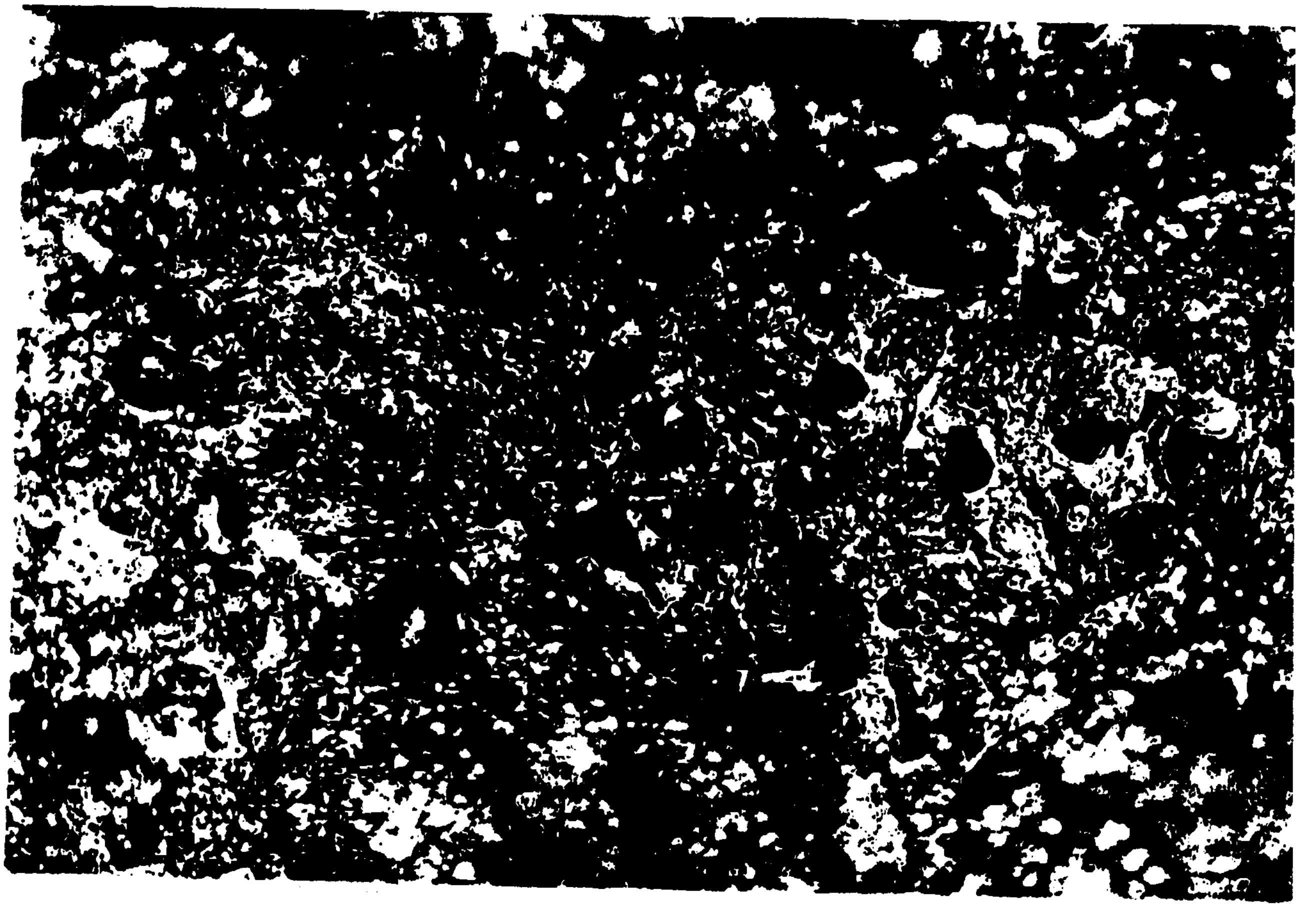


Figure 5. Microlites in brown slag fragment from OT-009-SP.

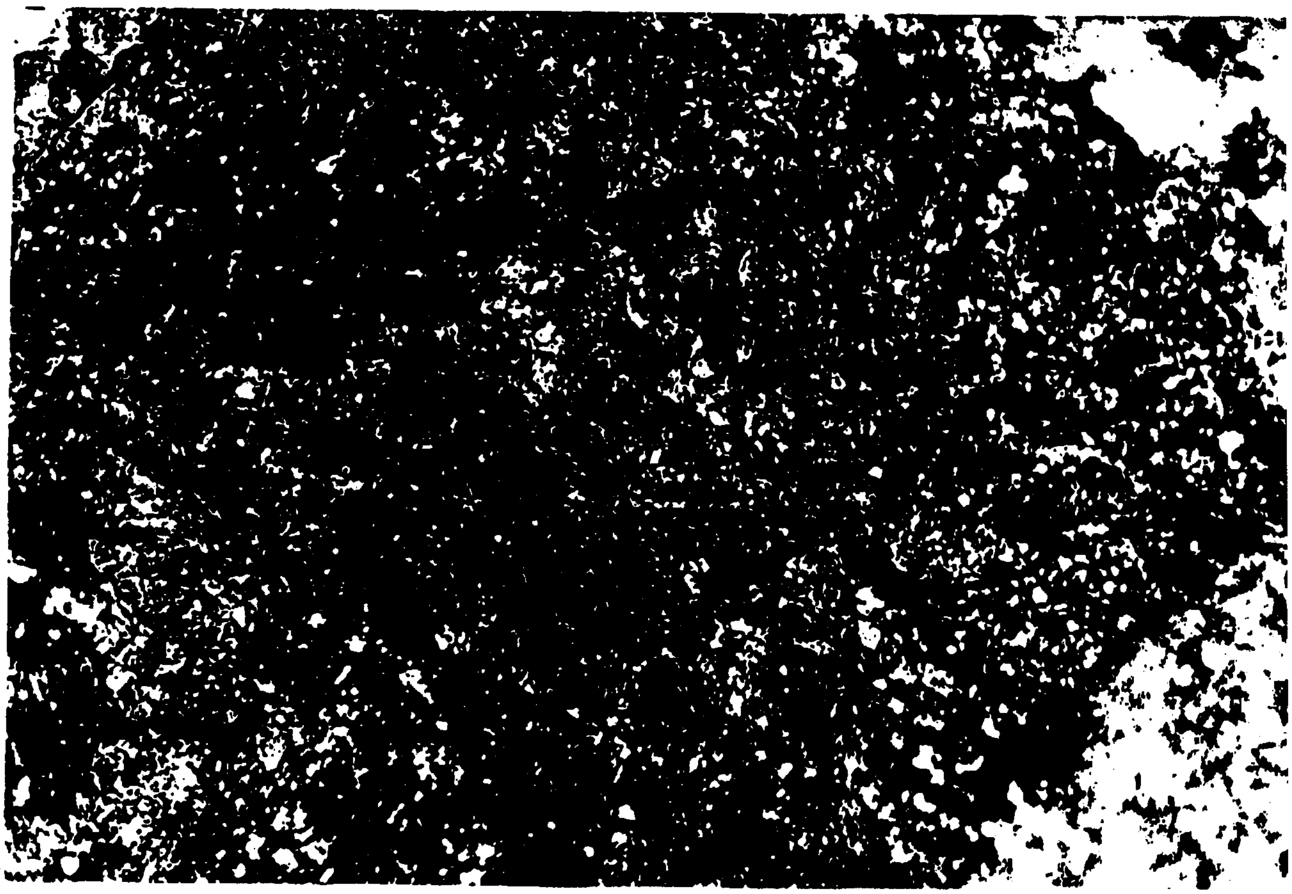


Figure 6. Microlites in blue slag fragment from OT-009-SP.

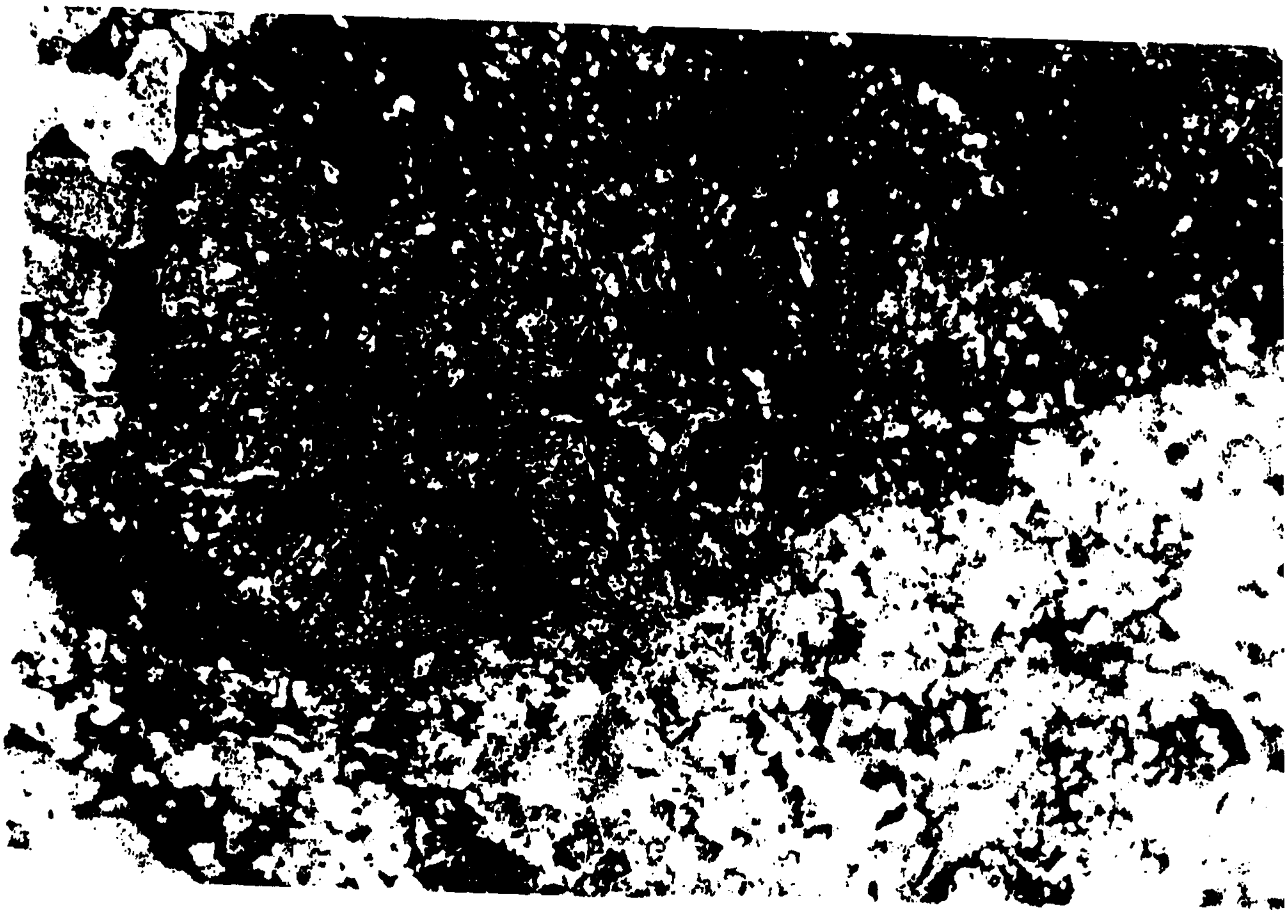


Figure 7. Microlites forming bubble walls in blue slag fragment from OT-009-SP.

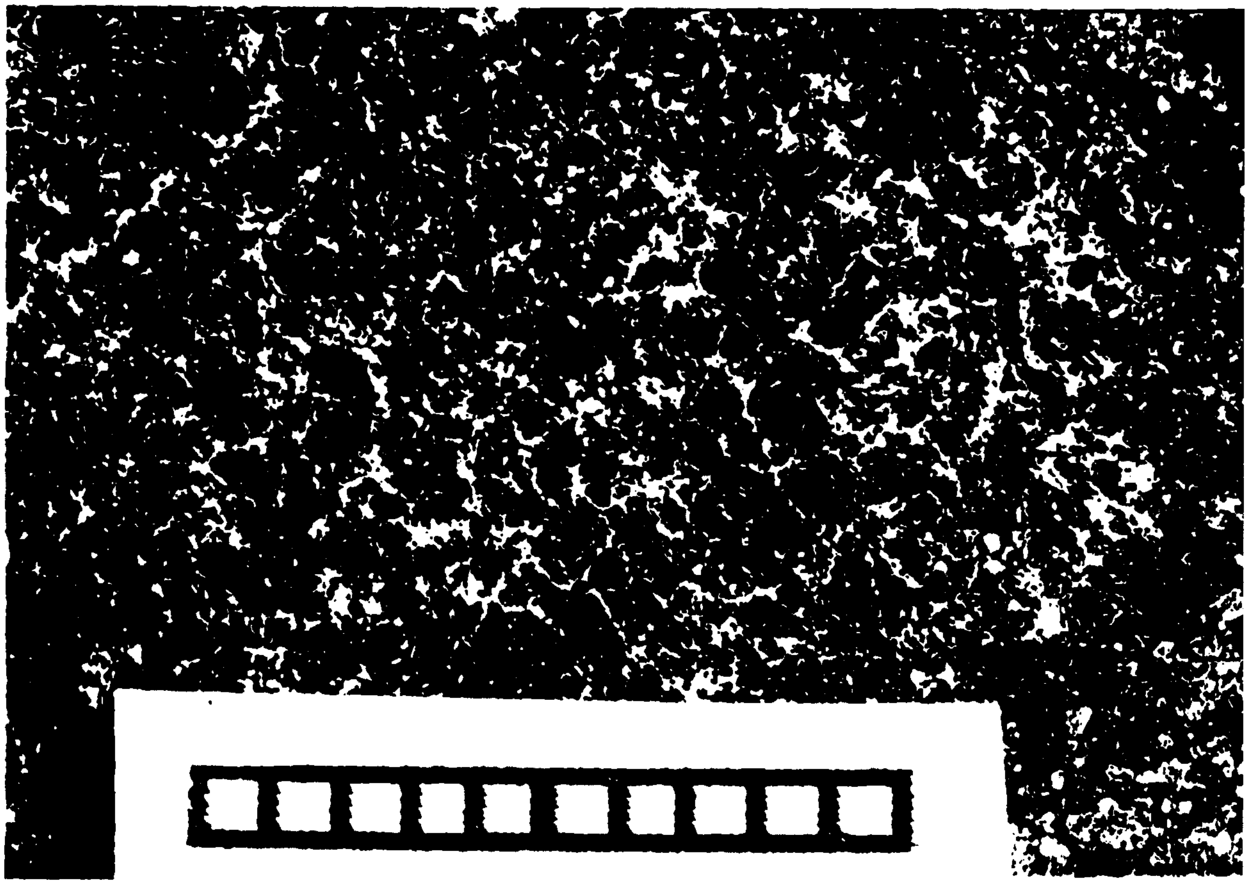


Figure 8. Boxwork vesicles caused by numerous microlites in slag fragment from OT-009-SP.

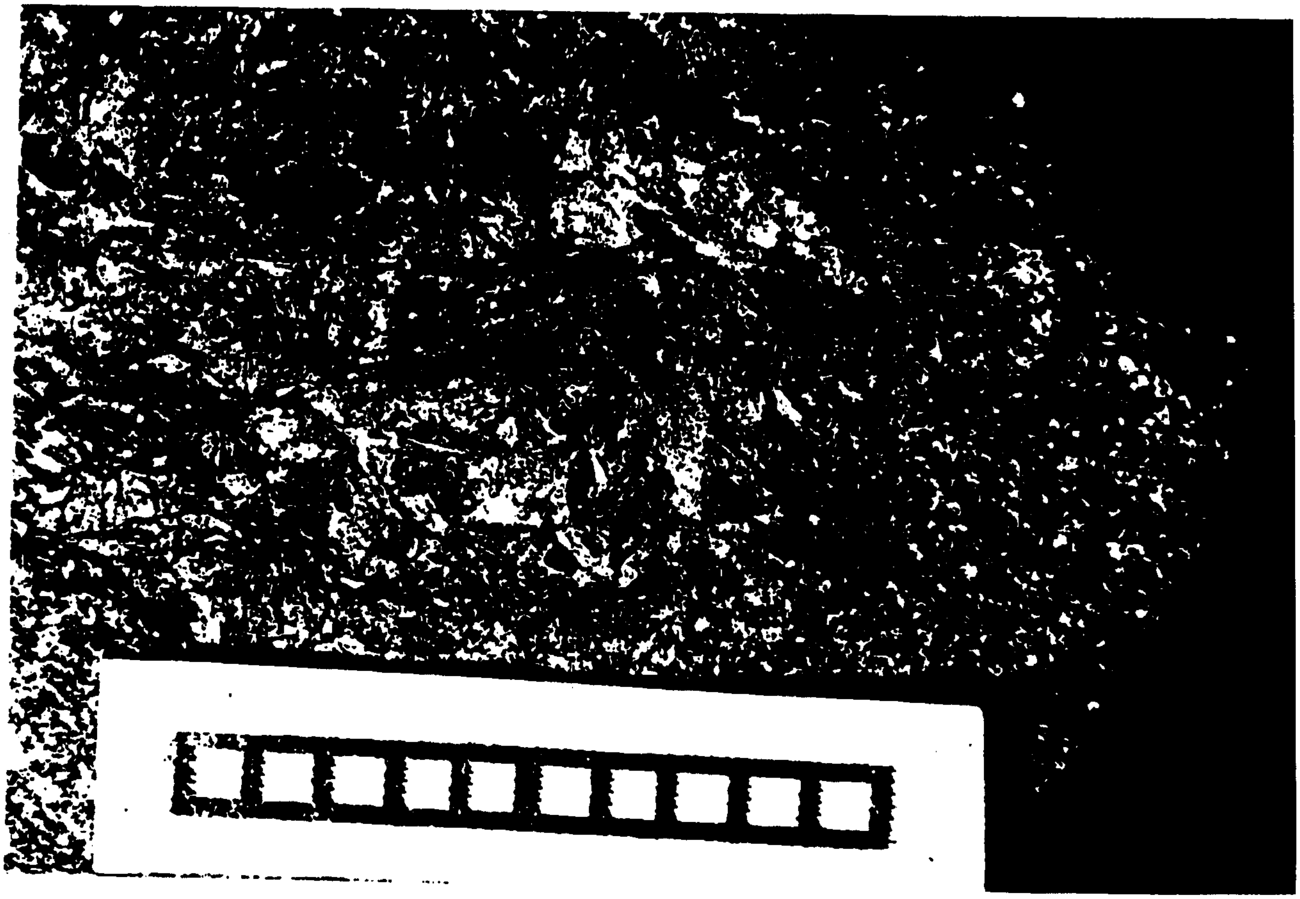


Figure 9. Tabular vesicles between crystals in white slag fragment from OT-009-SP.

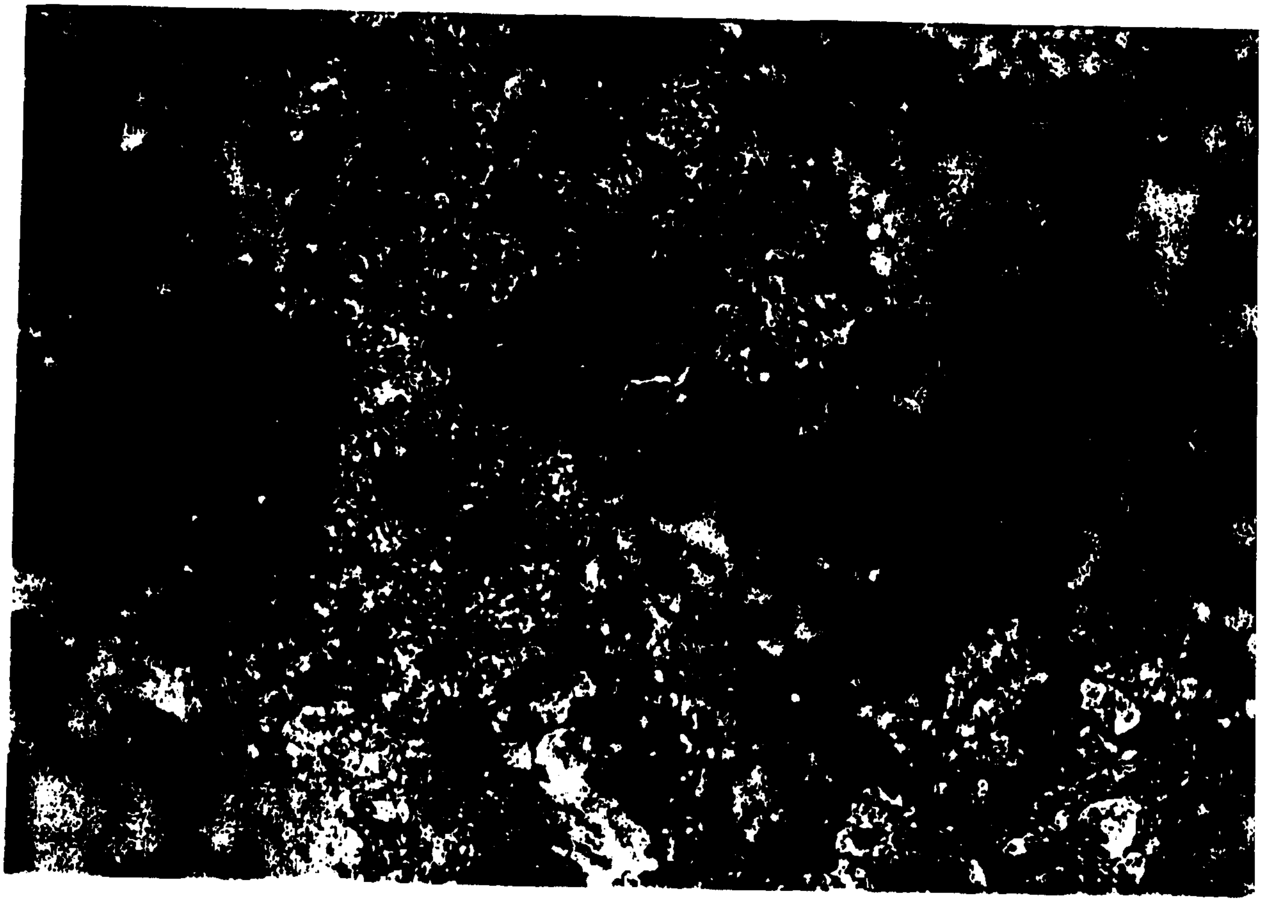


Figure 10. Sand-size vesicular slag fragment from OT-009-SP.

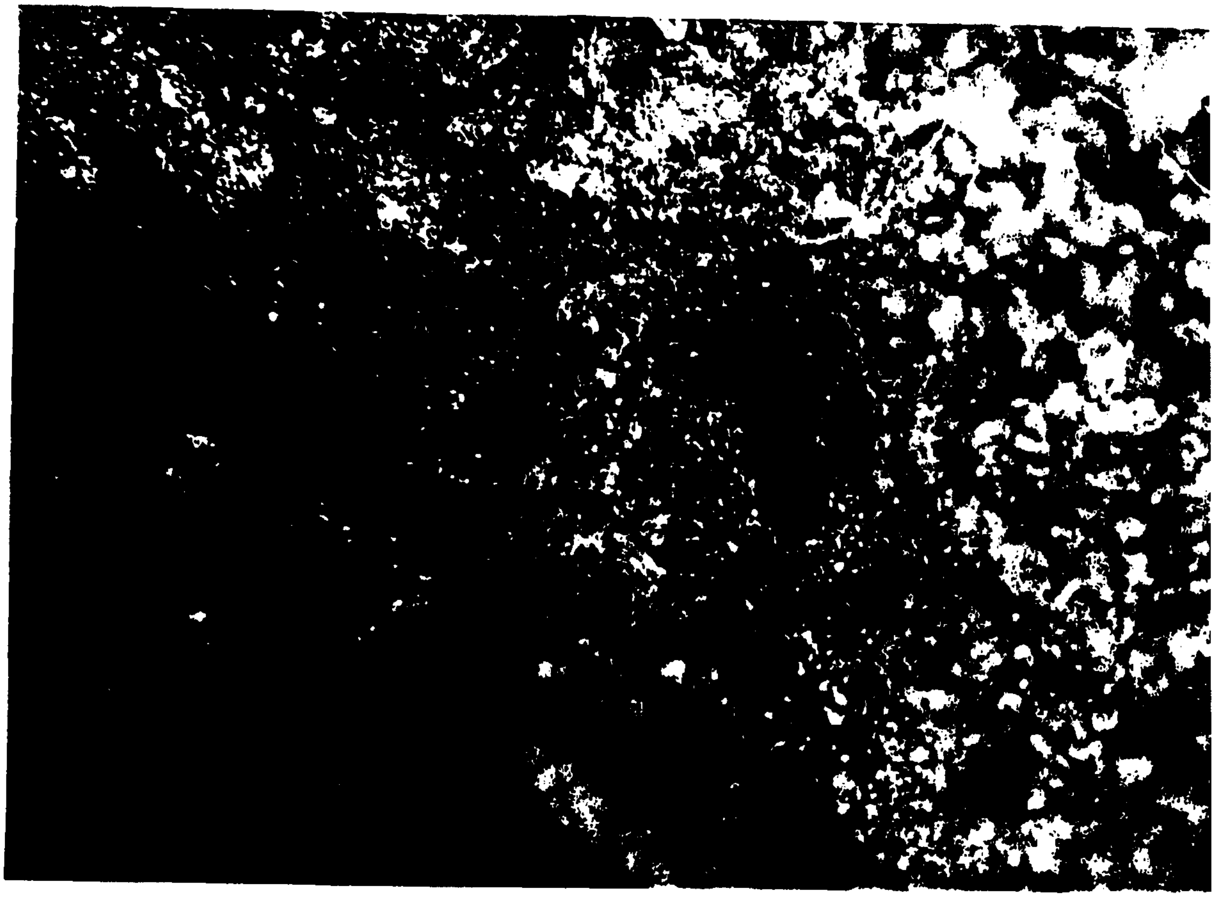


Figure 11. Green slag fragment from OT-009-SP.

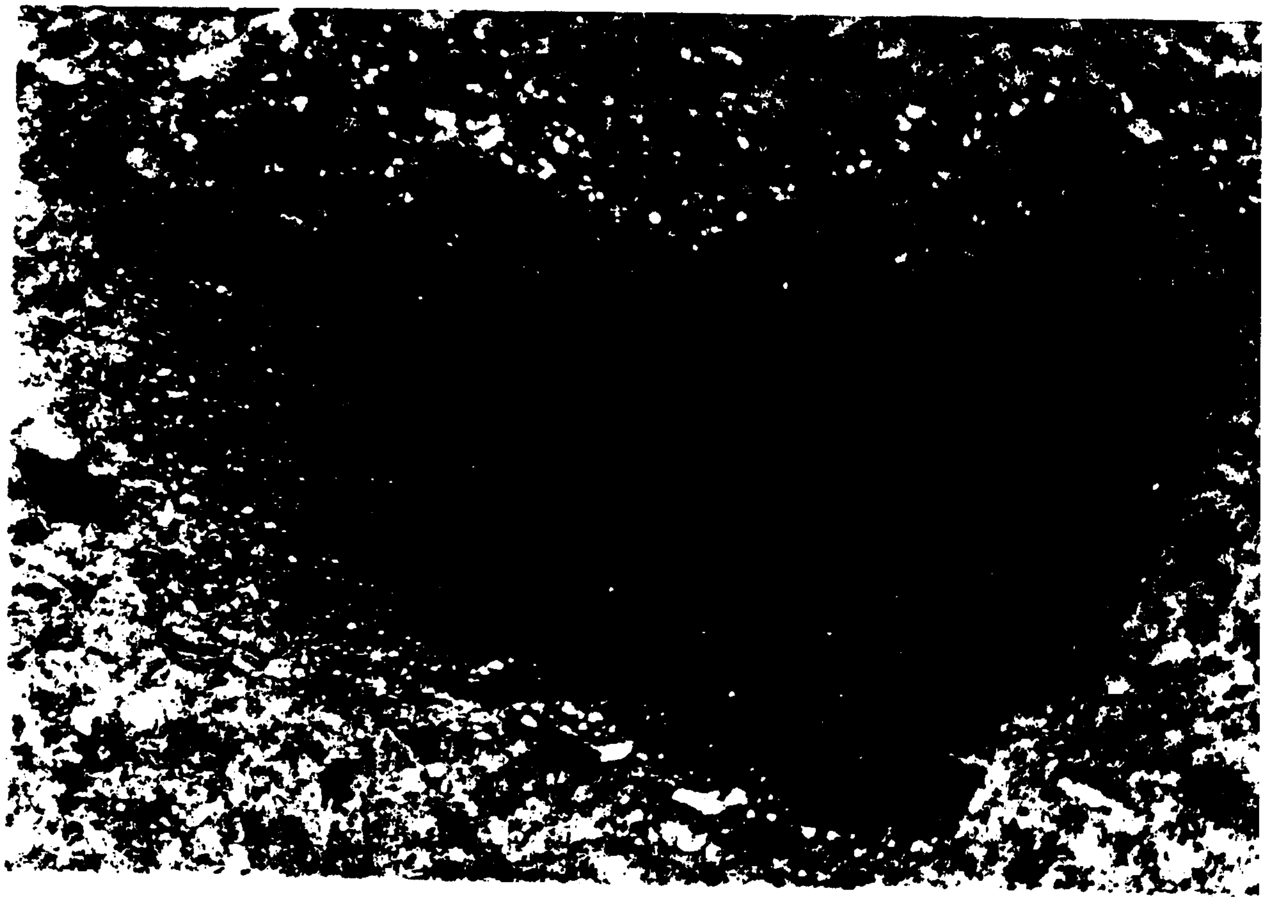


Figure 12. Blue slag fragment with prominent microlites from OT-003-BC.

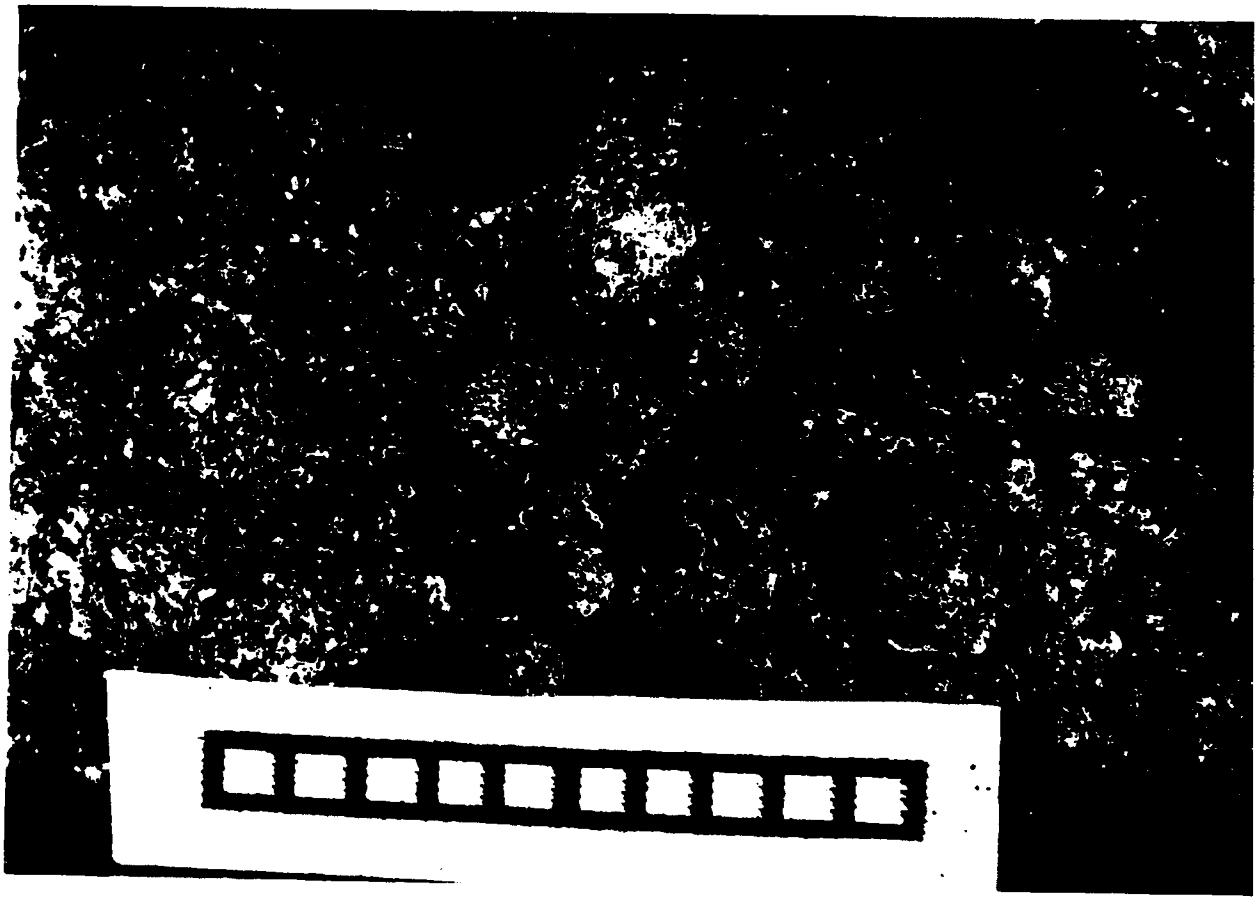


Figure 13. Large white scoriaceous slag fragment from OT-001-RP.

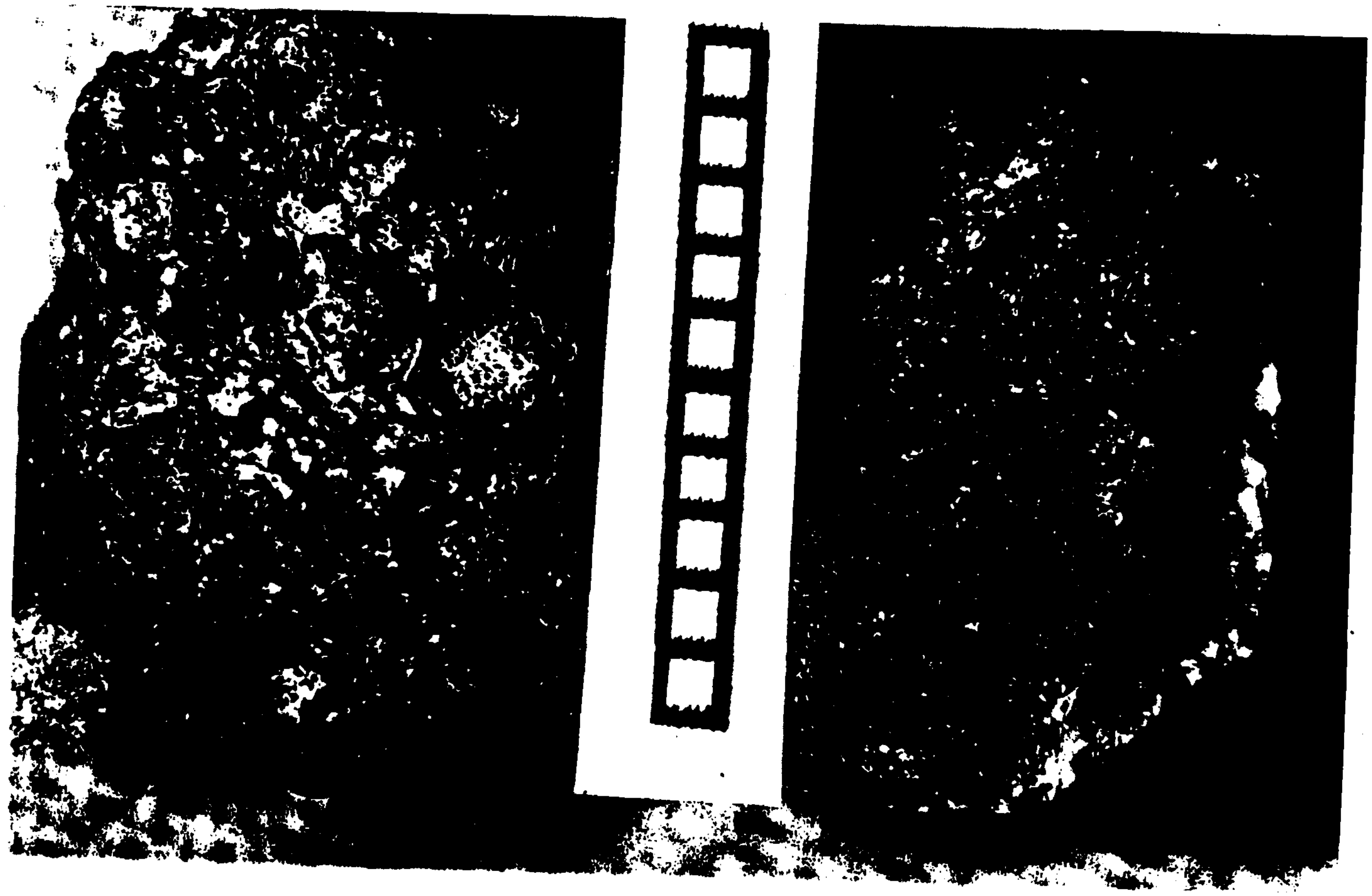


Figure 14. White scoriaceous slag fragment from OT-001-RP.

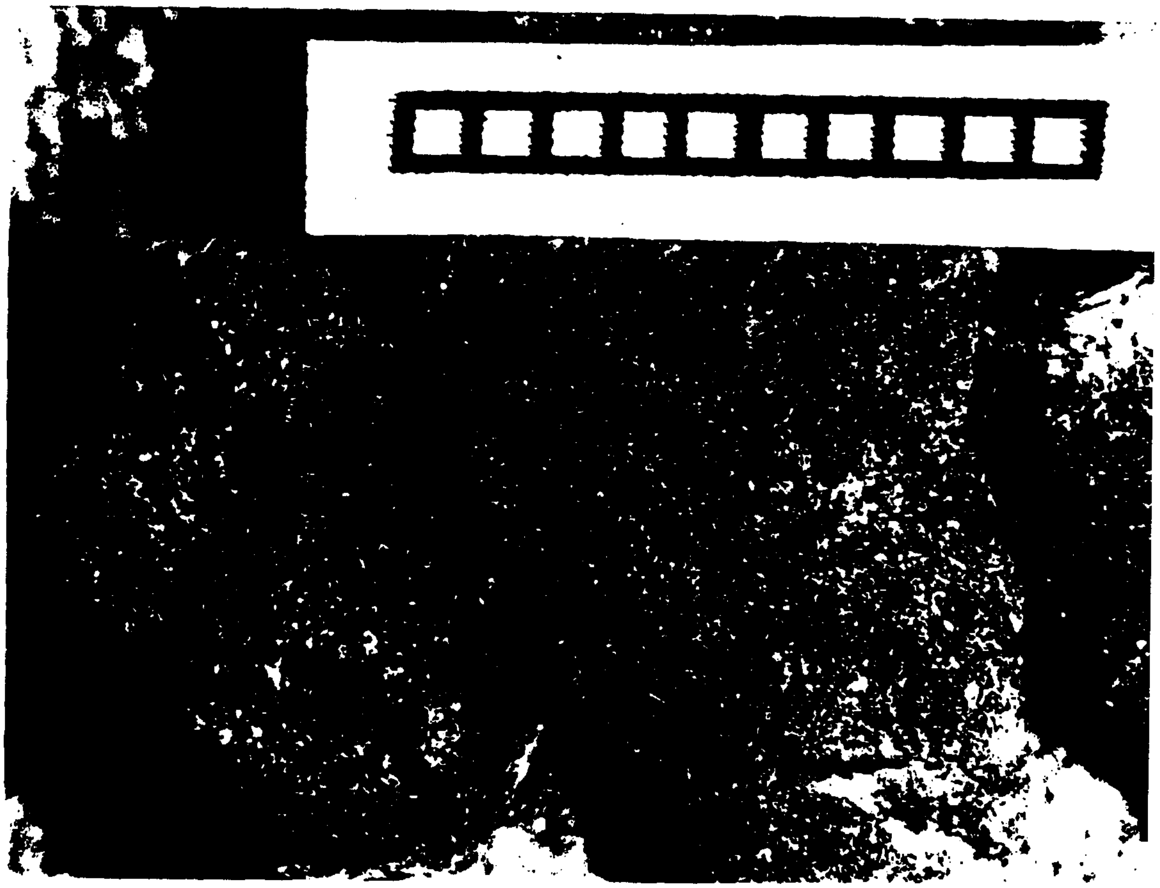


Figure 15. Slightly vesicular to non-vesicular slag fragment from OT-001-RP.

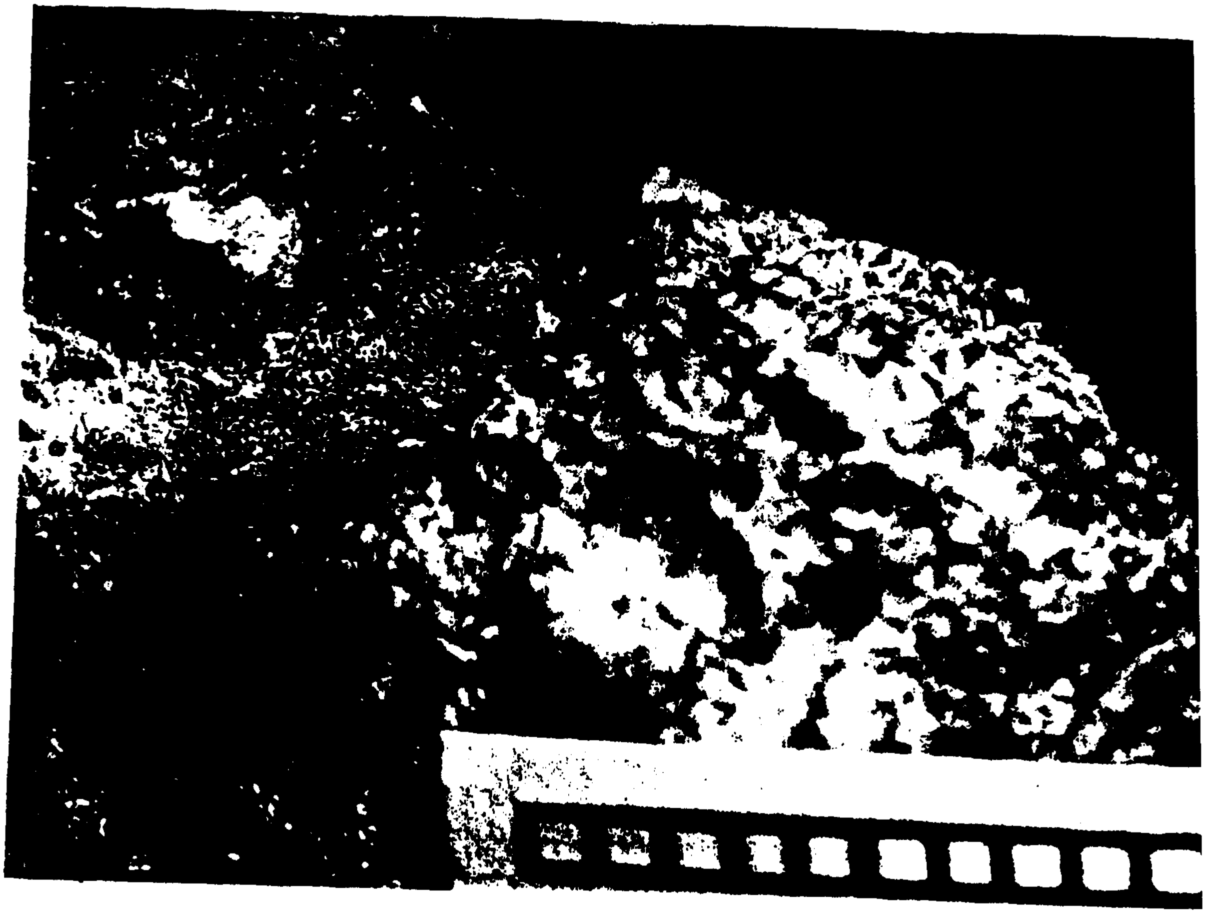


Figure 16. Prominent microlites in vesicular slag fragment from OT-001-RP.

APPENDIX FIGURES

Figures RP-1, BC-1 through BC-4, and SP-1 through SP-8

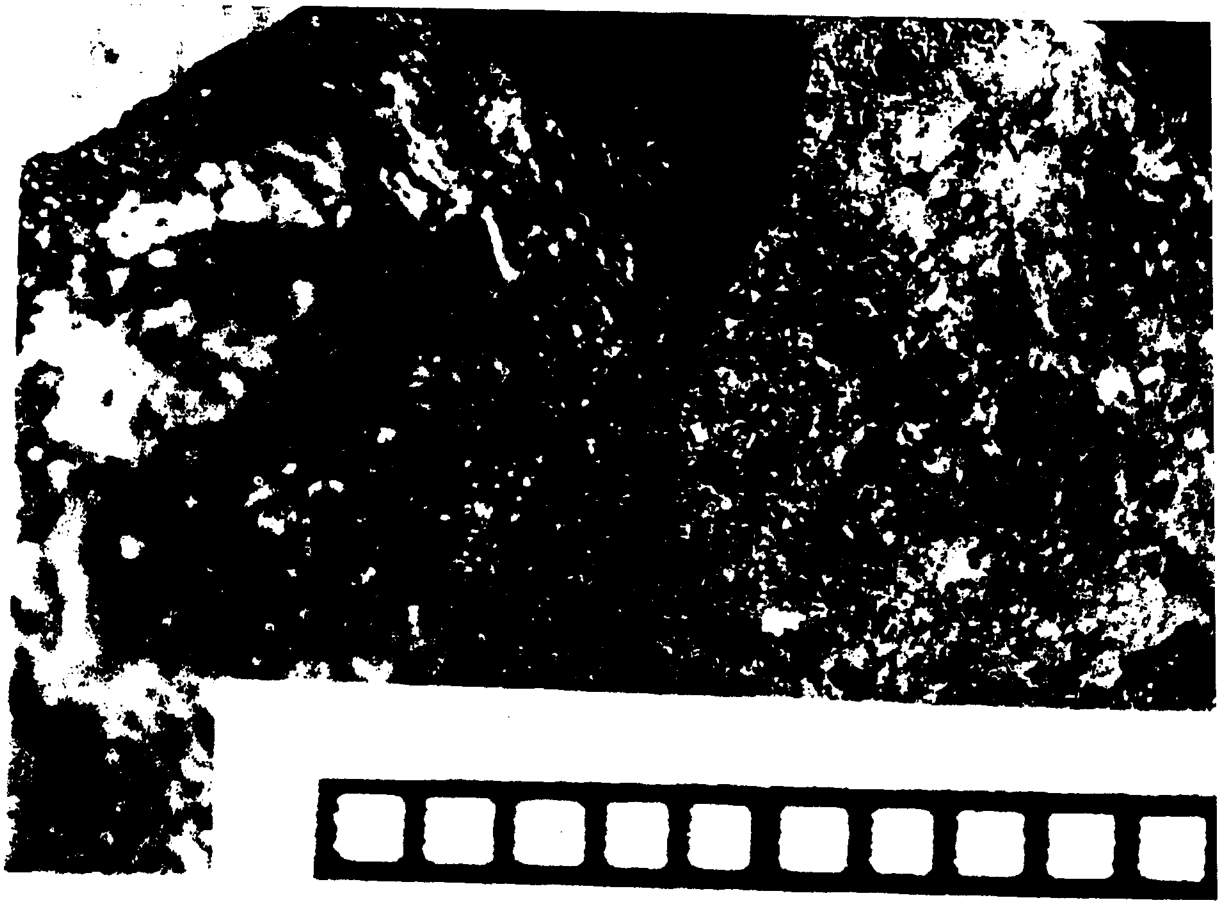


Figure RP-1. White and light-gray vesicular fragments from the road pavement sample (Sample C
Scale bar is 10mm long.

Figure BC-1. Gray vesicular fragment from the basement concrete sample (Sample OT-003-BC). Scale bar is 10mm long.

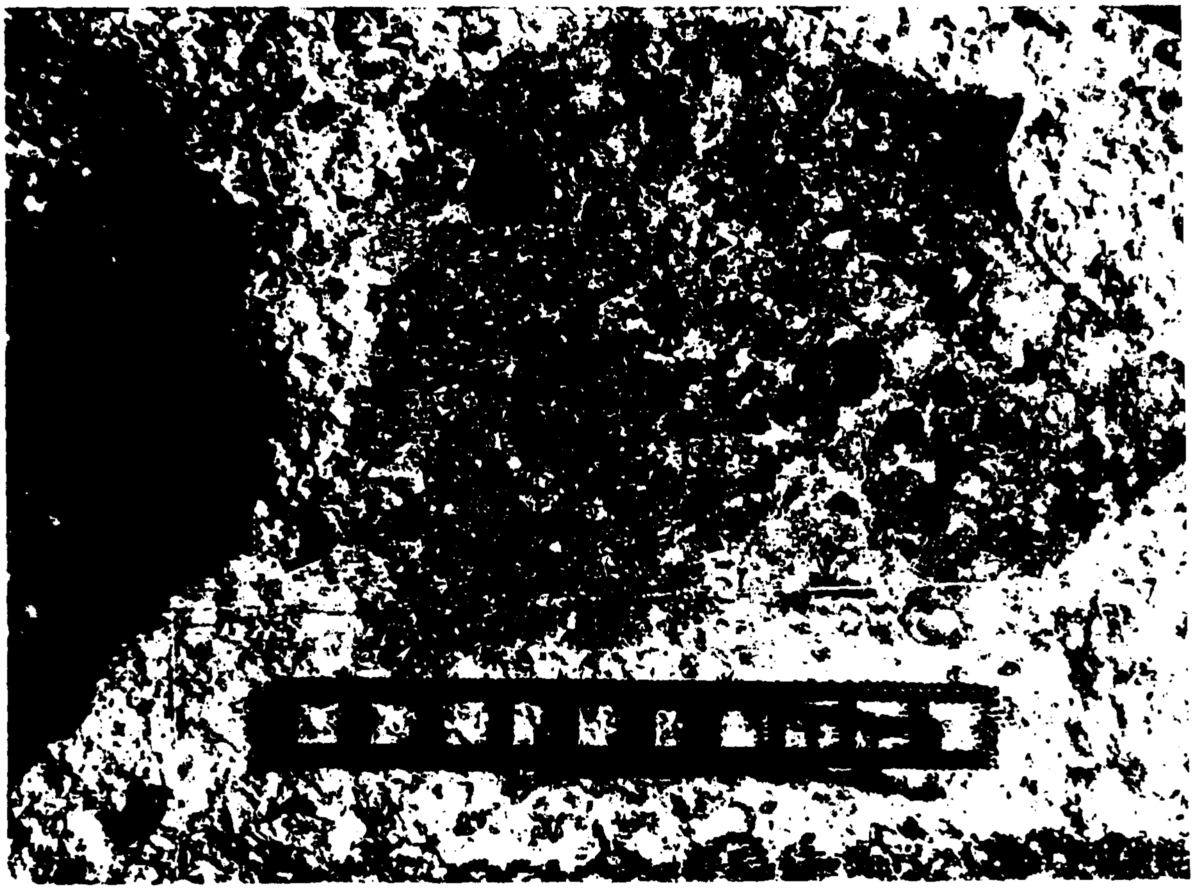


Figure BC-2. Gray vesicular fragment from the basement concrete sample (Sample OT-003-BC
Scale bar is 10mm long.

Figure BC-3. Gray vesicular fragment from the basement concrete sample (Sample OT-003-BC). Scale bar is 10mm long.

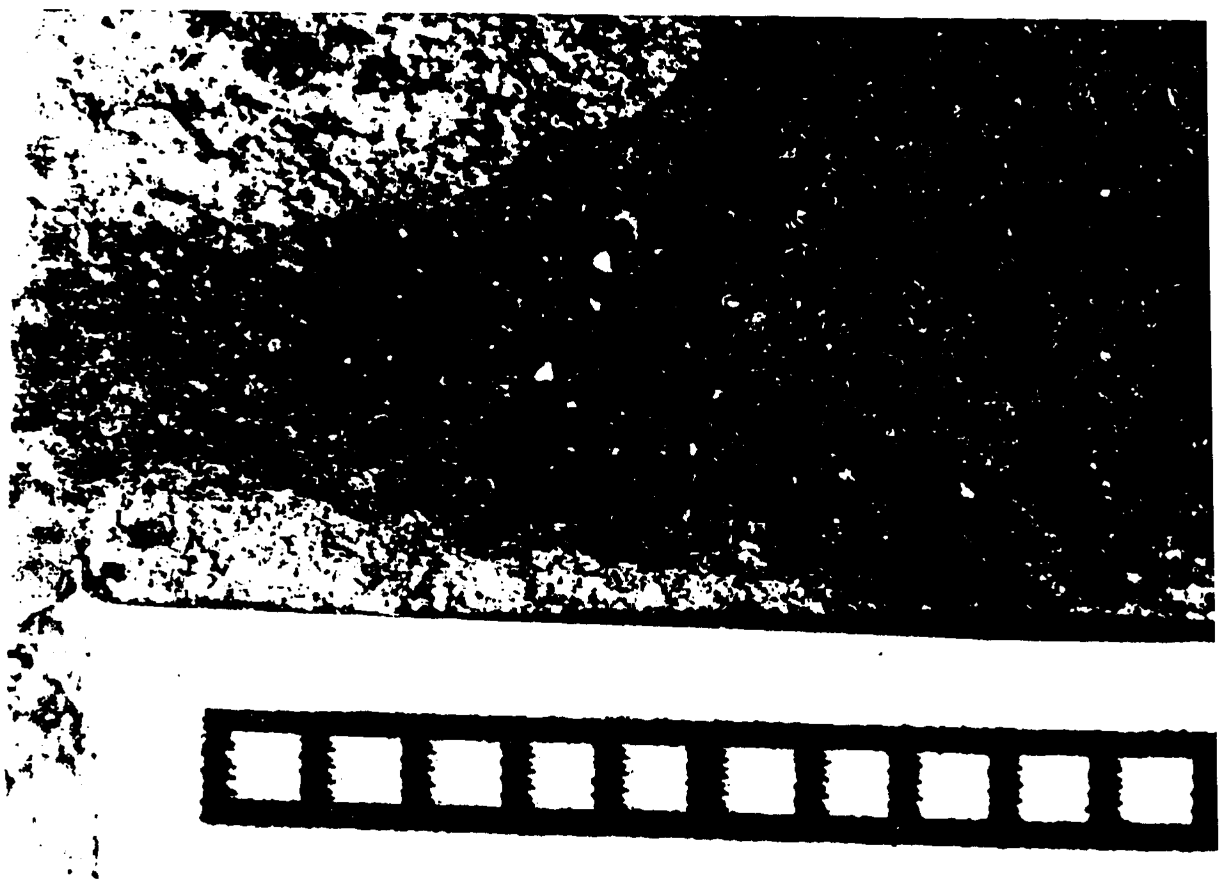


Figure BC-4. Blue vesicular fragment from the basement concrete sample (Sample OT-003-BC). Scale bar is 10mm long.

Figure SP-1. Gray vesicular fragment from the Stauffer Plant sample (Sample OT-009-SP). Scale bar is 10mm long.

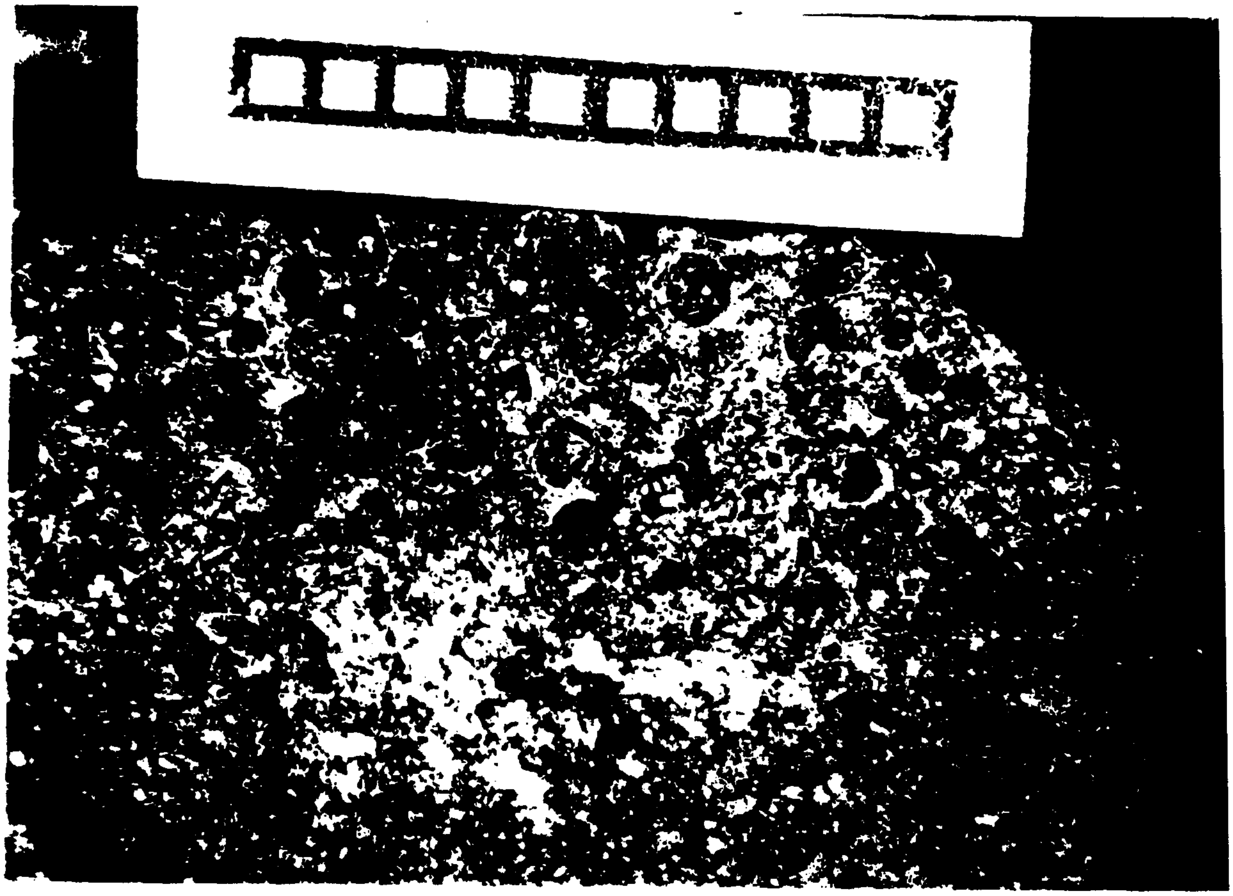


Figure SP-2. Brownish vesicular fragment from the Stauffer Plant sample (Sample OT-009-SP). Scale bar is 10mm long.

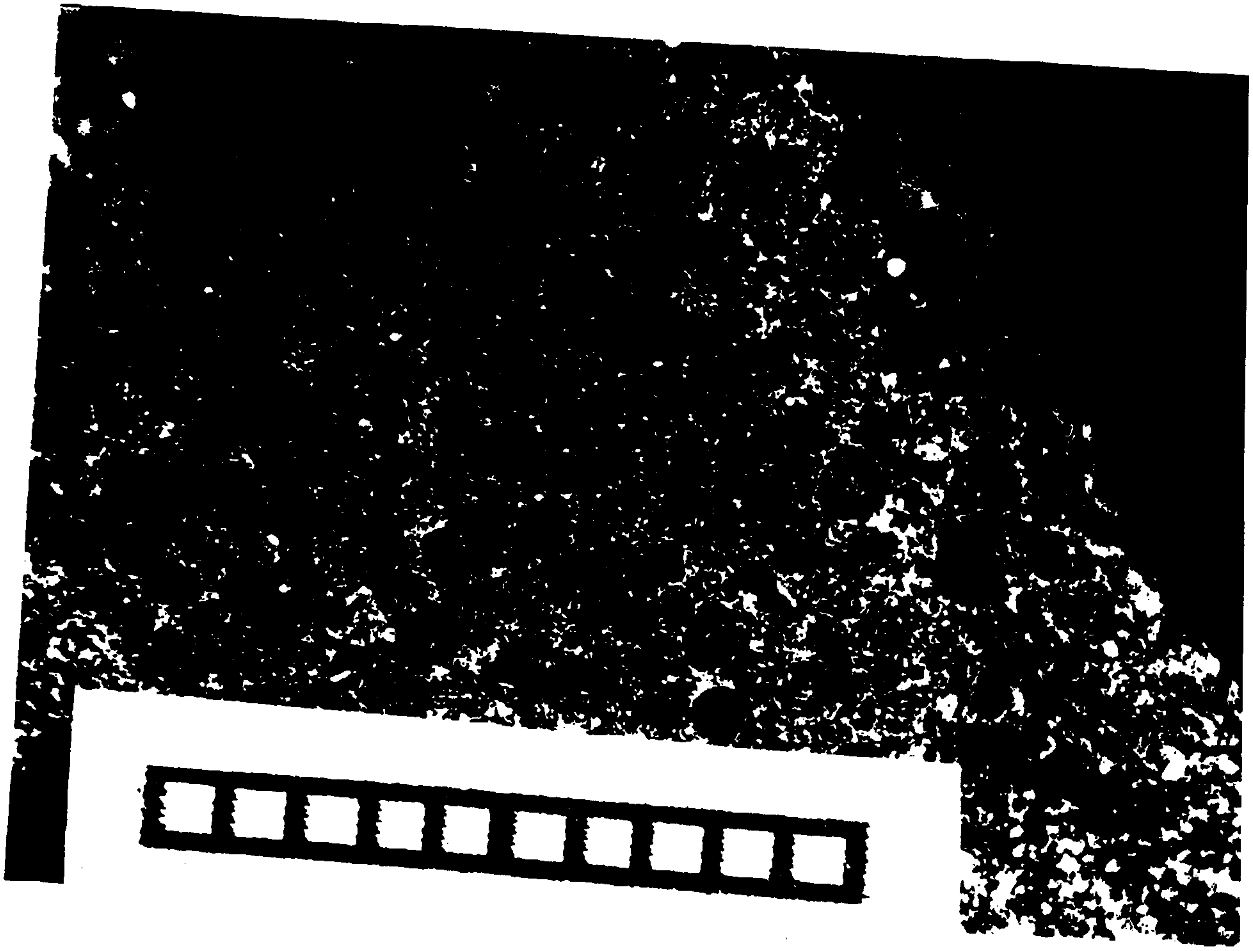


Figure SP-3. Gray vesicular fragment from the Stauffer Plant sample (Sample OT-009-SP). Scale bar is 10mm long.

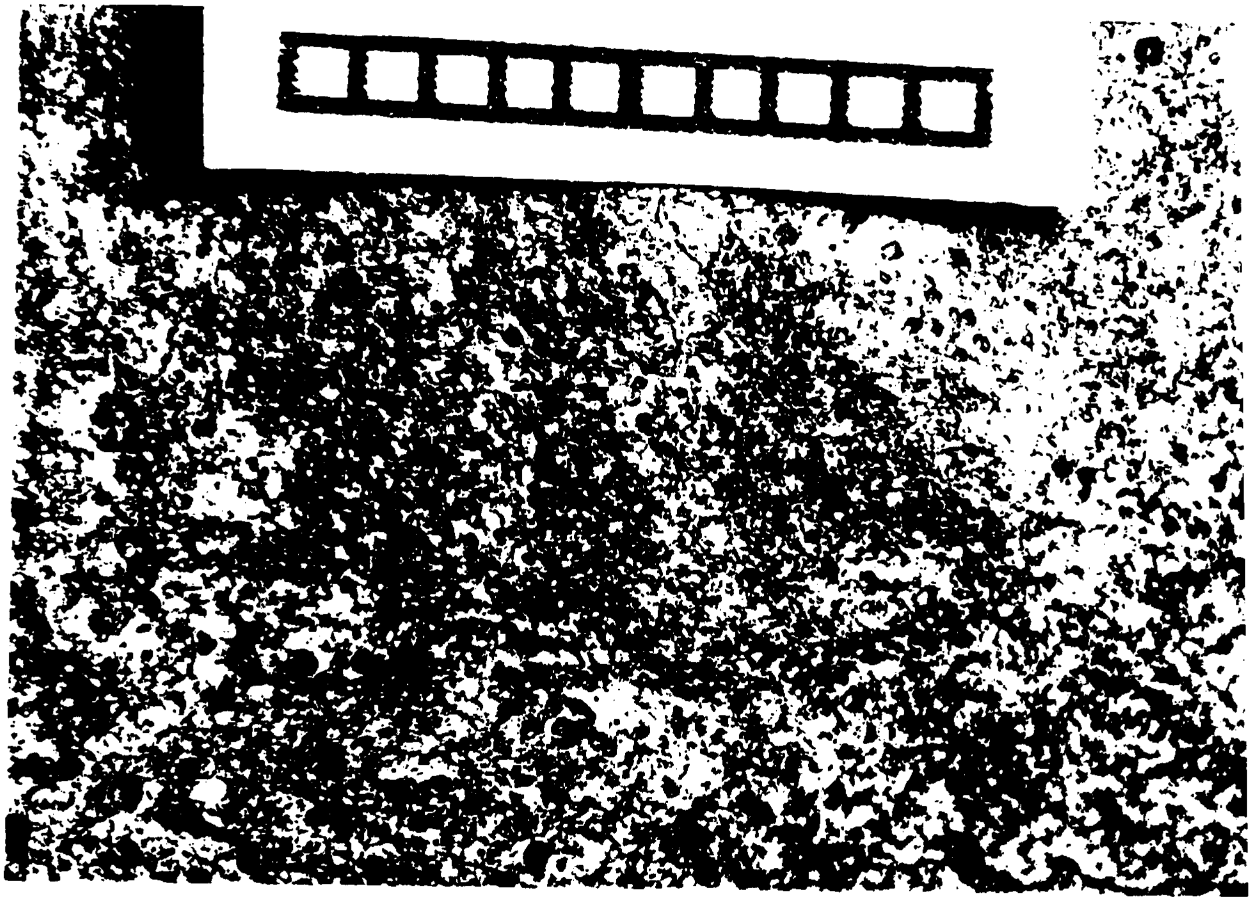


Figure SP-4. Tan vesicular fragment from the Stauffer Plant sample (Sample OT-009-SP).
Scale bar is 10mm long.

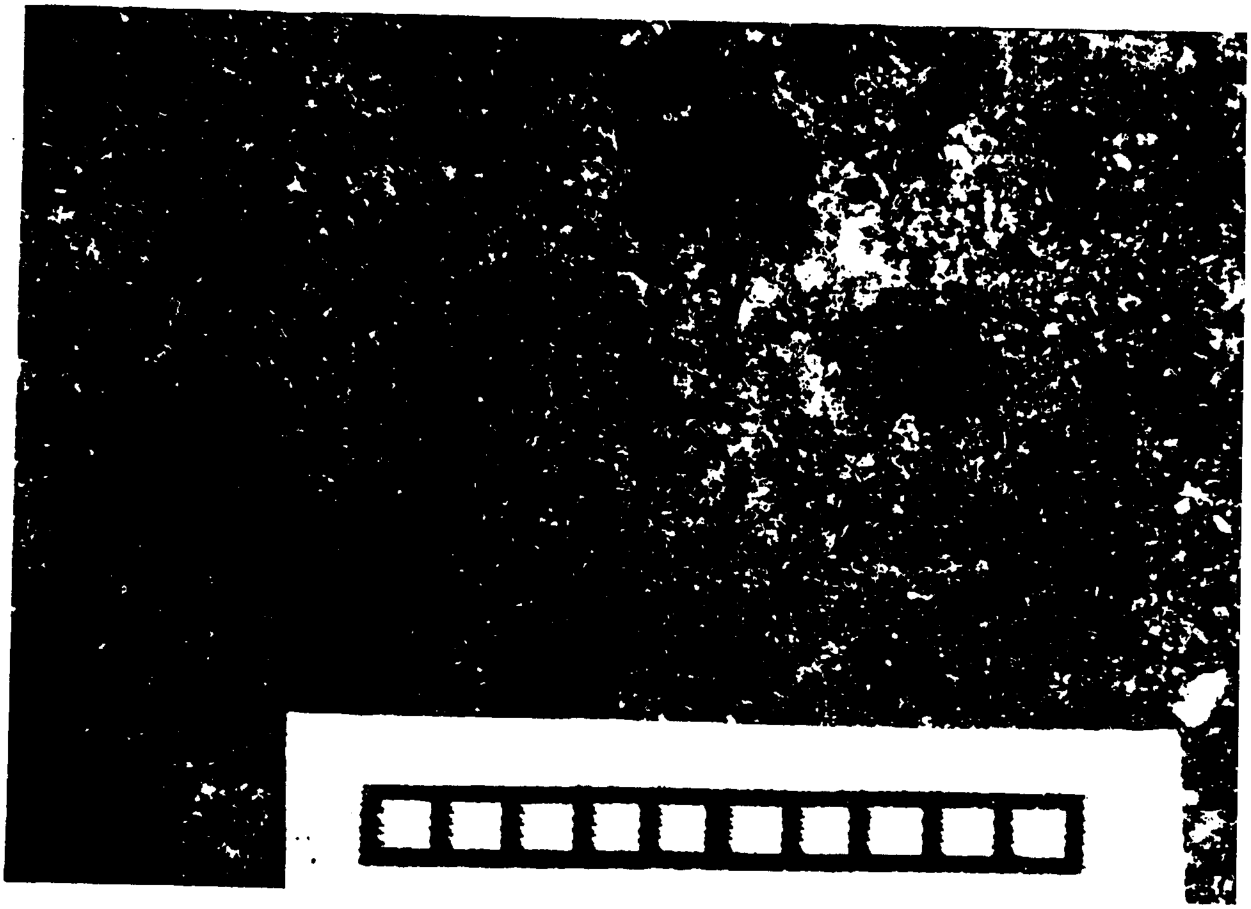


Figure SP-5. White vesicular fragment from the Stauffer Plant sample (Sample OT-009-SP). Scale bar is 10mm long.

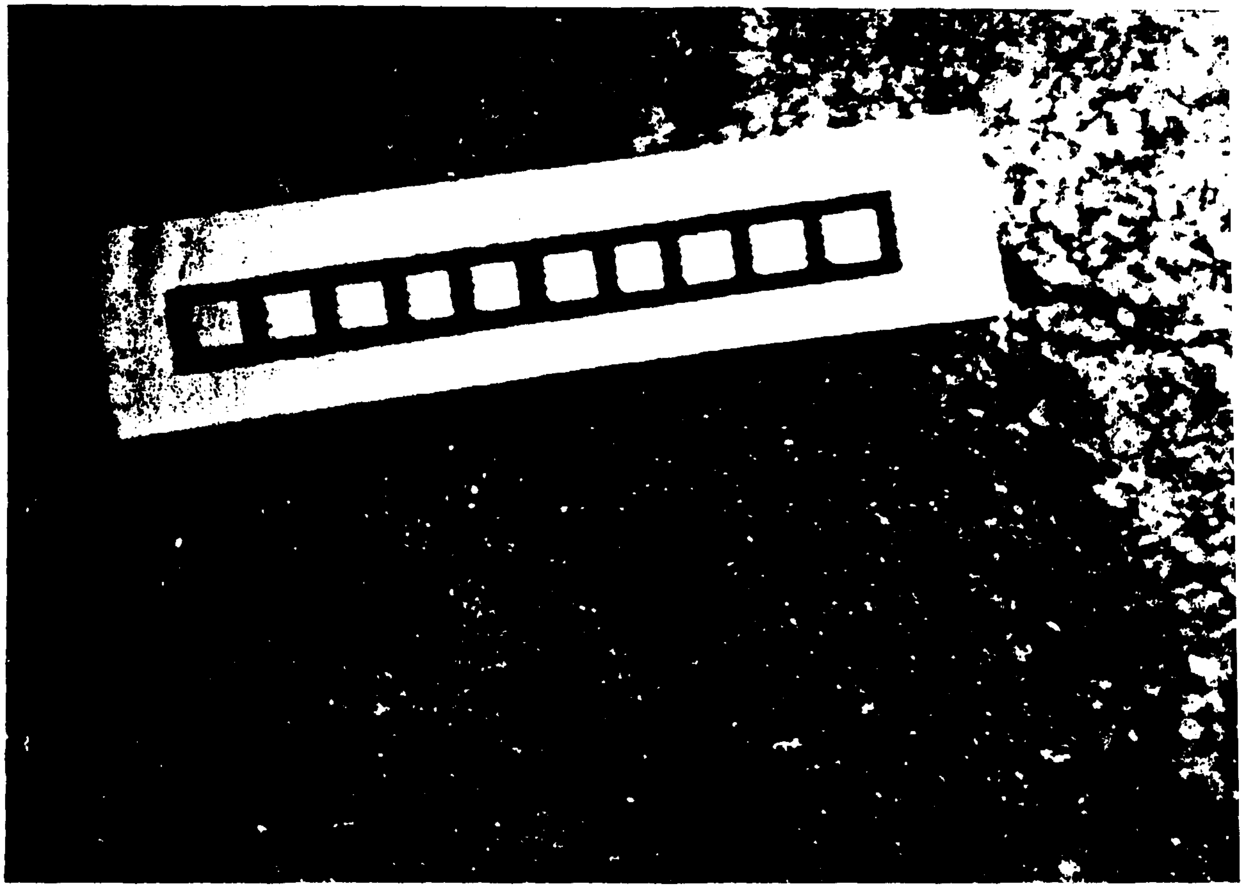


Figure SP-6. Blue vesicular fragment from the Stauffer Plant sample (Sample OT-009-SP).
Scale bar is 10mm long.

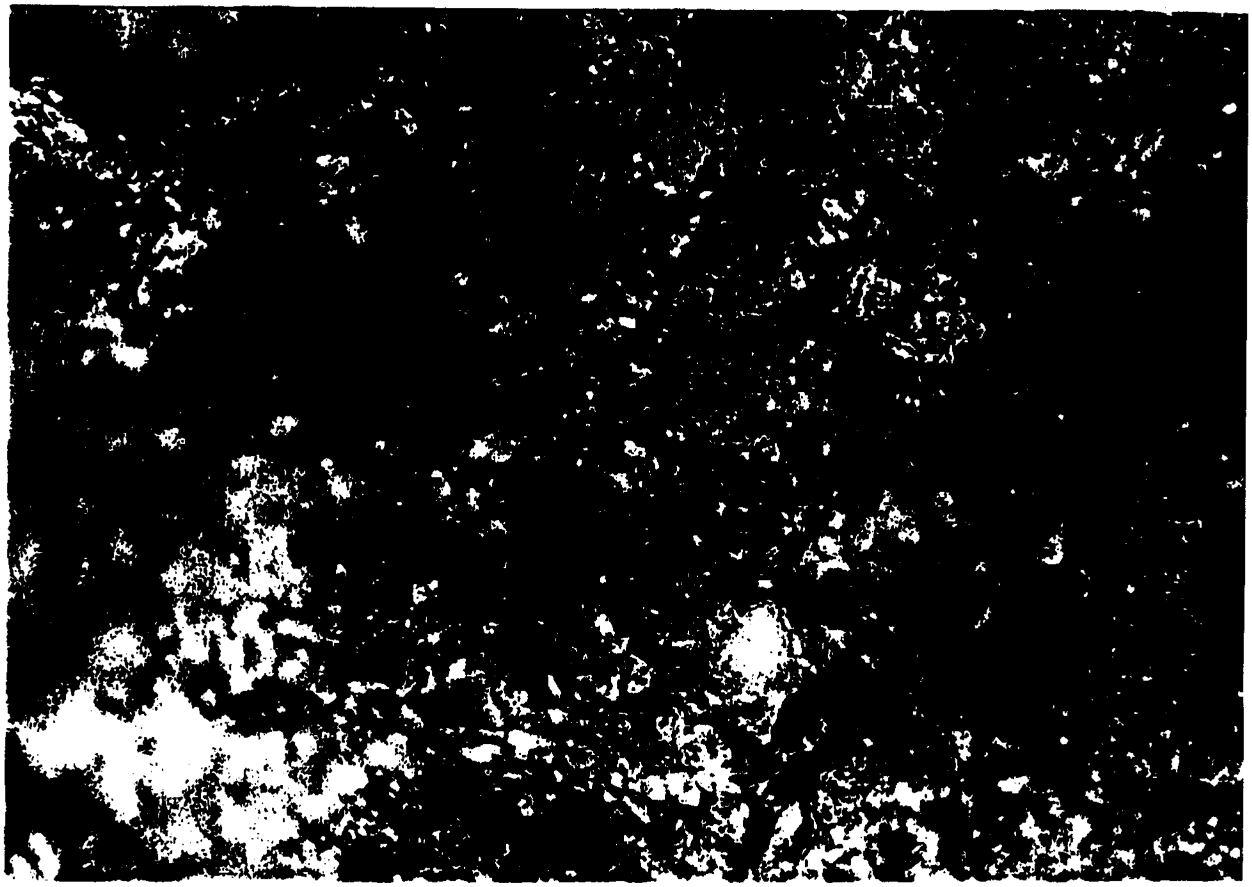


Figure SP-7. Prominent microlites in small fragment from the Stauffer Plant sample (Sample OT-009-SP). 5mm field of view.

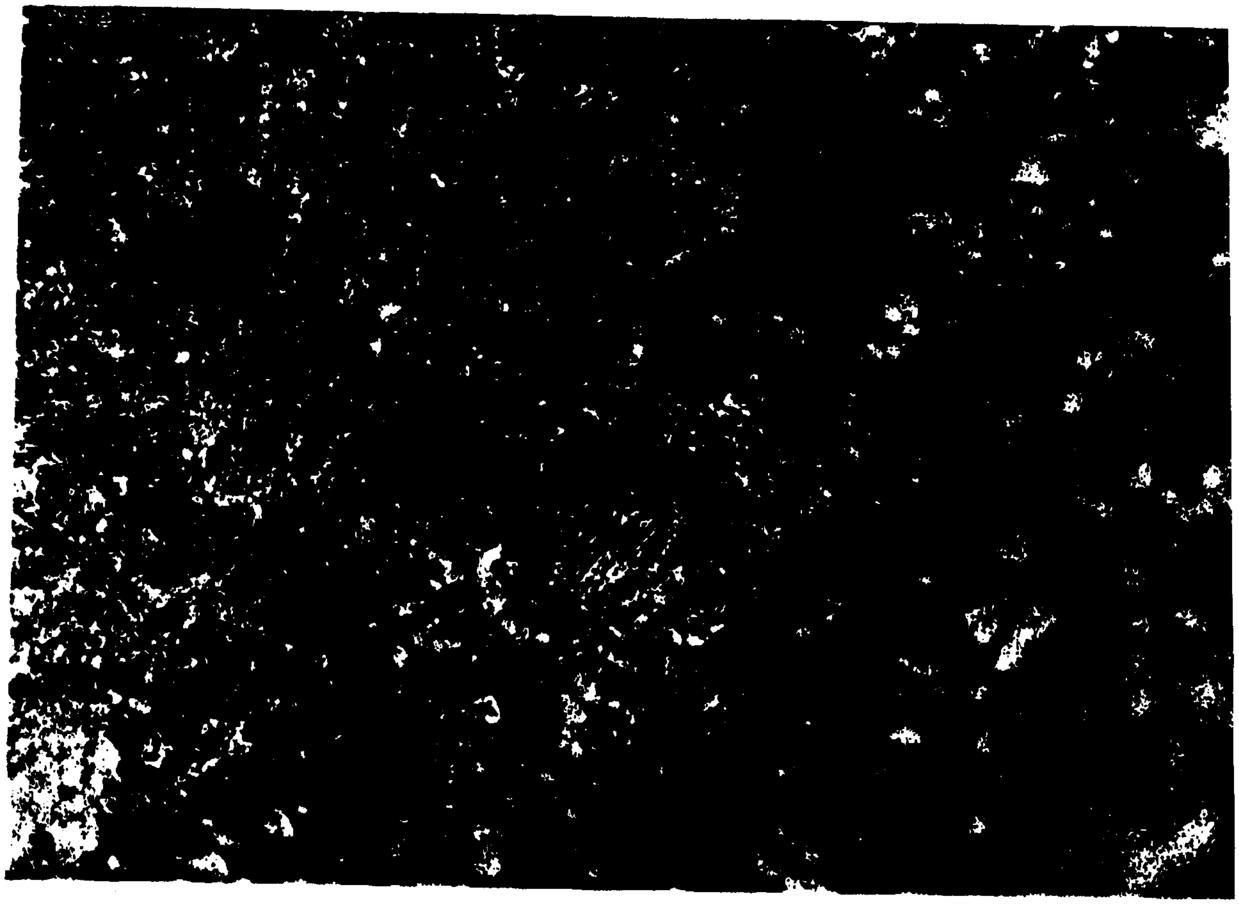


Figure SP-8. Prominent microlites in small fragment from the Stauffer Plant sample (Sample OT-009-SP). 5mm field of view.

Public Health Assessment for

PUBLIC HEALTH ASSESSMENT * ADDENDUM*
STAUFFER CHEMICAL COMPANY (TARPON SPRINGS)
TARPON SPRINGS, PINELLAS COUNTY, FLORIDA
CERCLIS NO. FLD010596013
AUGUST 6, 1999

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, is an agency of the U.S. Public Health Service. It was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by the EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of a health threat, if any, posed by a site and recommends ways to stop or reduce exposure in its public health action plan. ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by the EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible

TABLE OF CONTENTS

TABLES

BACKGROUND

In February 1998, the Agency for Toxic Substances and Disease Registry (ATSDR) received a petition from a Tarpon Springs, Florida, resident. The person requested that the agency investigate health problems that might be associated with exposure to slag materials used in residential areas of Tarpon Springs. Since then, the ATSDR has responded to letters from several other residents. The U.S. Environmental Protection Agency (EPA), Region IV also requested that the ATSDR review the sampling data taken at several vicinity properties near the Stauffer Superfund site in Tarpon Springs. The EPA asked the ATSDR to review chemical and radiological sampling data of residential slag, to evaluate exposure scenarios, to provide radiological dose estimates, and to make recommendations for protection of public health.

Since receiving letters from concerned Tarpon Springs residents, ATSDR staff members have begun investigating residents' health concerns and possible associations between those concerns and exposures to hazardous substances.

A. Site Description and History

From 1947 to 1981, the Stauffer Chemical Company (which operated under different ownership until 1960) made elemental phosphorus from phosphate ore using an arc furnace process. The processed ore was shipped off-site to produce agricultural products, food-grade phosphates, and flame retardants. While the chemical plant operated, waste products (i.e., slag) were disposed of on the plant property, shipped off-site by rail, and given to local residents to be used as fill and aggregate.

The Stauffer plant was added to the EPA Superfund list in 1994 because of pollution on the site. Superfund is a federal program for finding and cleaning up hazardous waste sites in this country. Since 1994, the EPA has been working to clean up the Stauffer site. The EPA is testing and monitoring the soil, water, and air at the site and at vicinity properties to protect nearby residents against health problems that might result from exposure to hazardous waste.

B. Site Visit

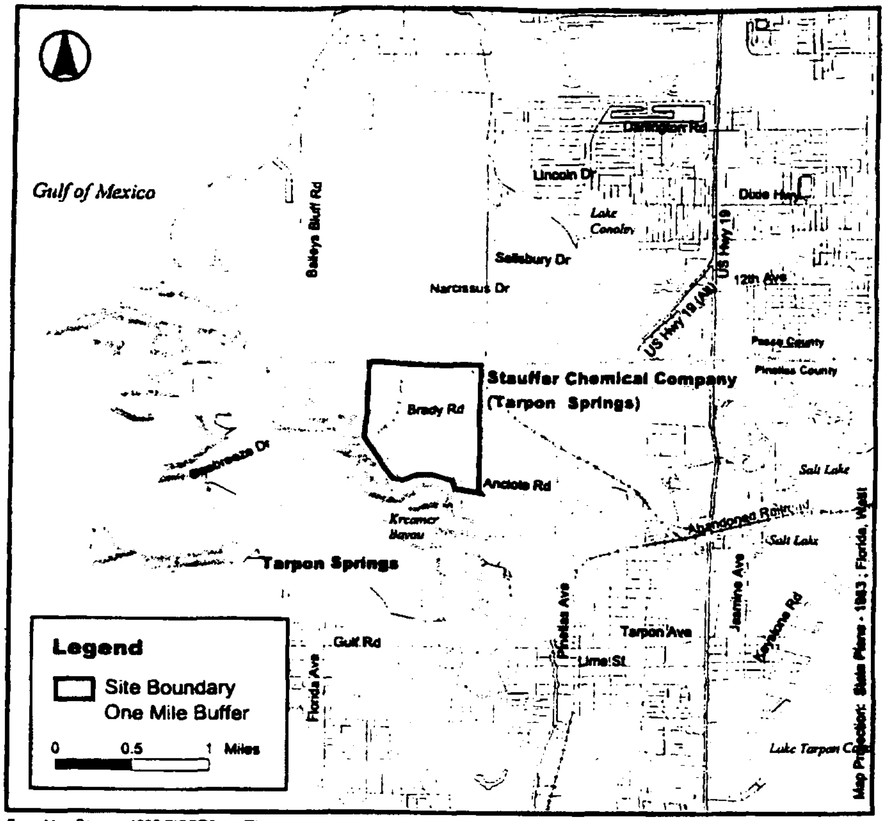
In May 1998, ATSDR staff members visited Tarpon Springs to meet with residents and to gather more information. Staff members addressed residents' questions. ATSDR and EPA Region IV personnel visited several vicinity properties in Tarpon Springs and Holiday, Florida. They saw the Stauffer Chemical Superfund site from the site boundary including the Anclote River. During a boat tour on the Anclote River, the ATSDR and the EPA were shown where slag from the site was used to fill in an inlet on site property.

In August 1998, EPA Region IV personnel and staff from EPA's National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama, took samples of building materials and roads and performed radiological surveys of several vicinity properties.

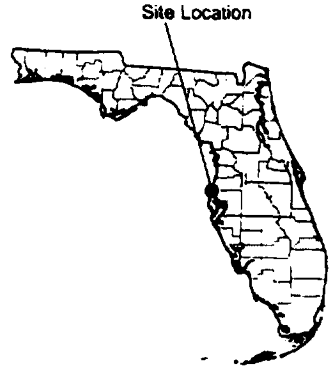
Stauffer Chemical Company (Tarpon Springs)

Tarpon Springs, Florida

CERCLIS No. FLD010596013



Base Map Source: 1995 TIGER/Line Files



Pinellas County, Florida

Demographic Statistics Within One Mile of Site*	
Total Population	9231
White	8936
Black	208
American Indian, Eskimo, Aleut	26
Asian or Pacific Islander	35
Other Race	23
Hispanic Origin	208
Children Aged 6 and Younger	549
Adults Aged 65 and Older	2940
Females Aged 15 - 44	1465
Total Housing Units	4906

Demographics Statistics Source: 1990 U.S. Census
*Calculated using an area-proportion spatial analysis technique

Population Density

Source: 1990 U.S. Census

Children 6 Years and Younger

Source: 1990 U.S. Census

Adults 65 Years and Older

Source: 1990 U.S. Census

Females Aged 15 - 44

Source: 1990 U.S. Census

SAAGIS

FA102398

B. Quality Assurance and Quality Control

In preparing this public health assessment (PHA), the ATSDR relied on the information provided in the referenced documents. The agency assumed that adequate quality assurance and quality control measures were followed with regard to chain-of-authority, laboratory procedures, and data reporting. The validity of the analyses and the conclusions drawn in this document was determined by the availability and reliability of the referenced information.

PUBLIC HEALTH IMPLICATIONS

All the radium levels sampled at off site residences and the associated gamma radiation were elevated above the local average for background radiation. The National Council on Radiation Protection and Measurements (NCRP), in its report number 116 on page 50, states that some building materials can contain naturally occurring radioactive materials and should only be remediated if annual doses exceed 500 millirem per year (8). The lowest observed adverse effect level (LOAEL) from ionizing radiation is from 10,000 to 50,000 millirem in a short period of time (i.e., less than a week) and is seen as a slight decrease in blood cell count (7). (Note: A millirem is equivalent to a millirad for gamma radiation.)

Of the four homes sampled in the Tarpon Springs area, only one exceeded 100 millirem per year, from structural building materials. Residence #1 had elevated radiation levels, especially in the basement. Using a conservative scenario, the annual dose to a young child living in a basement bedroom could receive about 210 mrem/yr additional background dose, which is well below the NCRP's 500 mrem/yr guideline (8).

The ICRP and NCRP recommendations are very conservative and are a factor of 100 below the LOAEL for acute exposure to ionizing radiation. Even though the total dose including radon would be 310 mrem/yr, this is still roughly the national average background dose in the United States of 300 mrem/yr (9). No adverse health effects would be expected from residing in the most affected home.

Phosphate slag at sampled vicinity properties does not appear to contain sufficient heavy metals to represent a public health hazard, based on current medical, epidemiological and toxicological information. For non-radioactive chemicals and metals, the ATSDR uses comparison values (contaminant concentrations in specific media and for specific exposure routes believed to be without risk of adverse health effects) to select contaminants for further evaluation. The ATSDR and other agencies have developed the values to provide guidelines for estimating media contaminant concentrations that are not likely to cause adverse health effects, given a standard daily ingestion rate and standard body weight. Table 5 lists environmental media exposure guidelines (EMEGs) and reference media exposure guidelines (RMEGs).

Many of these values have been derived from animal studies. Health effects are related not only to the exposure dose, but to the route of entry into the body and the amount of chemical absorbed by the body. Several comparison values might be available for a specific contaminant. To protect the most sensitive segment of the population, the ATSDR generally selects the comparison value that uses the most conservative exposure assumptions.

Natural Background Radiation

Natural radiation and naturally occurring radioactive materials in the environment provide the major source of radiation exposure to the public. For this reason, natural background radiation is often used as a comparison for man-made sources of ionizing radiation. Background radiation comes from cosmic sources, naturally occurring radioactive materials including radon, and global fallout as it exists in the environment from testing of nuclear explosive devices. Although

CONCLUSIONS

1. Phosphate slag from the Stauffer Chemical Superfund site reportedly has been used as concrete aggregate in homes, roads and roadbeds in the Tarpon Springs and Holiday, Florida vicinity.

2. Although there is elevated background radiation from radium-containing slag and aggregate, the total background dose to a maximally exposed child in residence #1 is roughly the national average background dose of 300 mrem per year.

3. Annual background dose contribution from building materials to the maximally exposed child in residence #1 does not exceed the NCRP's recommended limit of 500 mrem per year.

4. Phosphate slag at sampled vicinity properties, does not appear to contain sufficient leachable heavy metals to represent a public health hazard, based on current medical, epidemiological and toxicological information.

5. Combined exposures from driveways and roads containing phosphate slag are not a health threat.

RECOMMENDATION

The ATSDR recommends that public health education be provided to help the public better understand that there is currently no general public health hazard posed by the phosphate slag and to provide information to community members on the environmental health effects presented in the Stauffer Chemical Vicinity Properties public health assessment addendum.

REFERENCES

1. Bureau of the Census, U.S. Department of Commerce, Washington, DC, 1990 Census Data Files.

2. Memorandum dated September 2, 1998, from Rick Button, Health Physicist to John Blanchard, Remedial Project Manager, US EPA. Report on radiological surveys conducted and observations for the offsite Stauffer Chemical visit of August, 1998 in Tarpon Springs, FL.

3. Memorandum dated September 17, 1998, from John Griggs, Chief Monitoring and Analytical Services Branch to John Blanchard, US EPA Region IV, Waste Division. Radiochemical results for Tarpon Springs Samples.

4. Florida Department of Health. Preliminary Public Health Assessment for Stauffer Chemical Company/Tarpon Springs, Tarpon Springs, Pinellas County, Florida. FDOH: Tallahassee, August 4, 1993.

5. Florida Department of Health, Bureau of Environmental Toxicology, Under Cooperative Agreement with the Agency for Toxic Substances and Disease Registry, Health Consultation for the Gulfside Elementary School, Holiday, Florida dated June 18, 1998.

6. ICRP (1990). International Commission on Radiological Protection (ICRP) Recommendations of the International Commission on Radiological Protection. ICRP Publication 60. New York: Pergamon Press. 1990.

7. National Council on Radiation Protection and Measurements. Influence of Dose and Its Distribution in Time on Dose-Response Relationships for Low-LET Radiations, NCRP Report No. 64. NCRP: Bethesda, 1980.

8. National Council on Radiation Protection and Measurements. Limitation of Exposure to Ionizing Radiation, NCRP Report No. 116. NCRP: Bethesda, March 31, 1993.

9. National Council on Radiation Protection and Measurements. Exposure of the Population in the United States and Canada from Natural Background Radiation, NCRP Report No. 94. NCRP: Bethesda, December 30, 1987.

10. National Council on Radiation Protection and Measurements. Ionizing Radiation Exposure of the Population in the United States, NCRP Report No. 93. NCRP: Bethesda. September 1, 1987.

Table 2 Stauffer Chemical Vicinity Properties - Residence 2

Location:	Residence 2	µrad/hr (waist level)
#1	bedroom	20
#2	bedroom	21
#3	bedroom	20
#4	bedroom	22
#5	bedroom	26
#6	bedroom	27
#7	bedroom	28
#8	bedroom	21
#9	bedroom	25
#10	bedroom	27
#11	bedroom	29
#12	bedroom	27
#13	bedroom	21
Annual Dose	from building materials	76 (mrem)

Note: One thousand microrad (µrad) are equivalent to one millirem (mrem) for gamma radiation. To calculate an Annual Dose, averaged the readings, then subtracted local background of 6 µrad/hr and assumed 12 hours per day in the bedroom and 5 hours in other parts of the house for 350 days per year.

Table 5 Maximum Contaminant Concentrations in Parts per Million (ppm)

Contaminant	Driveway Pavement	Driveway Base	Yard Soil	Comparison Value
Antimony	0.0566	0.252	0.0469	20 (Chronic RMEGs Child)
Arsenic	4.85	3.84	0.829	20 (Chronic RMEGS Child)
Beryllium	1.24	1.92	0.749	100 (Chronic RMEGS Child)
Chromium	27.7	22.3	49.6	200 (Chronic RMEGS Child)
Lead	18.2	11.7	31.8	400 (EPA Screening Level)
Thallium	0.70	0.614	0.0658	5 (Chronic RMEGS Child)
Vanadium	33.9	26.3	17.2	200 (Intermediate EMEG Child)
Radium-226	70.2 (pCi/g)	6.21 (pCi/g)	25.1 (pCi/g)	5 pCi/g to 5 cm depth 15 pCi/g below 5 cm (40 CFR 192)

Key: Reference Media Exposure Guideline (RMEGS)
Environmental Media Exposure Guideline (EMEG)
EPA Standards for Uranium and Thorium Mill Tailings {40 CFR 192 (1983)}
Code of Federal Regulations (CFR)

levels such as those which are estimated in this report. The ATSDR should also list the occupational dose limit of 5,000 mrem per year as a level considered safe for occupational radiation workers.

Converted all units discussed to millirem.

The report indicates that the PIC is calibrated in µrad per hour. It is my understanding that a PIC is designed to measure gamma radiation in air, which is properly measured with the unit Roentgens per hour or micro-Roentgens per hour. The rad describes the absorption of energy in tissue, not air, although the conversion from Roentgens to rads is simple. I do not, however, recommend the use of this unit since all the units in the report should be converted, as accurately as possible, to millirem to avoid confusion. However, my understanding of the definition of the Roentgen indicates that the statement of calibration of the PIC may be incorrect.

The PIC is calibrated using a NIST traceable standard, so that readings can be converted to µrad per hour. The chamber is constructed from a tissue equivalent material, so that readings are tissue equivalent and energy independent.

On page 7, the report refers to "high" concentrations of radium-226 in phosphate slag. From a radiation protection standpoint, the concentrations of radium-226 found in phosphate slag cannot be considered high since concentrations of radium-226 can be found in the natural environment which exceed these levels. A more appropriate characterization would be "elevated" such as was appropriately used at the top of page 8 and in other parts of the report.

Changed to "elevated", as suggested.

This report goes to great lengths to educate the public as to the potential radiation doses which might be received by persons who may be exposed to phosphate slag in their homes and in the environment. The ATSDR's use of the LOAEL provides a comparison which is easy to understand if it is listed in the same units. However, the ATSDR should inform the reader as to the proper use of the radiation protection guidelines which are referenced in the report.

Attempted to clarify the proper use of ICRP and NCRP guidelines.

Radioactive materials off-site appear similar to radioactive materials on the SMC site. The slag, regardless of where it occurs, has a low-- but elevated-- level of radioactivity. Simply put, the degree of danger from any radioactivity is directly proportional to the amount of slag nearby.

Slag contains naturally occurring radioactive materials, which is considered part of background. Doses did not exceed any applicable guideline.

Prior to these studies, it was thought there might be "hot spots" from particularly radioactive batches of slag. This would be difficult to determine on-site due to the enormous amounts of slag. However, off-site it could manifest as unusually radioactive driveways or foundations. Fortunately, these studies show this is not the case.

No change necessary.

The ATSDR does not feel further sampling is warranted, based on current sample results.

The most obvious shortcoming, of this health assessment is that the findings on which it is based are incomplete and standards are either absent, presented without explanation (Table 5), ignored or dismissed.

There are not always good or consistent guidelines available to make public health evaluations. The ATSDR strives to make public health evaluations of completed or potential exposures. If there is no exposure possible, then there is no health risk.

Mathematical projections of radiation exposure have been made, which may or may not approximate the actual exposure of affected individuals. This would be acceptable if there were no alternative way to collect experiential data. This is not the case, however. A sampling of affected residents needs to be given radioactivity-sensitive film badges to wear (over a period of time to be determined by the scientific community) to more accurately measure individual exposures. The local citizens deserve to be advised on the basis of information about what exposure is actually happening, rather than OD projections that do not take into consideration the life style of the individuals involved. Since techniques do exist to monitor the actual accumulation of exposure to radioactivity, and since the costs associated with that technique are not outrageously high, it seems to us that prudence would dictate that any scientist - and we assume that these results are being analyzed by scientists, not actuaries or risk managers- would not only recommend but urge that this extra step be taken to measure the actual, not the projected, exposure of the affected citizens.

Film badges would not be sensitive enough and tend to fade. The ATSDR would recommend that any homeowner interested in measuring their individual dose obtain a Thermo-Luminescent Dosimeter (TLD) from a local accredited lab.

The solubility, and thus the toxicity levels, of arsenic in offsite materials have not been investigated. The theory that arsenic is trapped and chemically/biologically unavailable is unsubstantiated. There have been no specific studies indicating that this is the case in any or all contaminated areas being included in these generalized conclusions. Pursuant to this lack of convincing data of the solubility of arsenic and other chemical contaminants, the questions relating to potential groundwater contamination have gone unasked and unanswered. Wells located in any areas with significant slag need to be tested for the contaminants of concern. The question of contaminated groundwater below contaminated offsite areas has been ignored.

EPA samples were leach tested for heavy metals including arsenic and the lack of measurable quantities of arsenic and other heavy metals in leachate demonstrate that the material is insoluble and therefore not bioavailable.

There appears to be no agreement on what standards for arsenic are acceptable. While local citizens were once led to believe that 10^{-6} risk levels for arsenic were to be applied as clean-up levels (.4 ppm or .8 ppm, depending on whether federal or state guidelines are referenced), this no longer seems to be the case. The PHA Draft itself makes no mention of the current disagreement over standards, and instead lists an RMEGS Comparison Value of 20, which has the affect of minimizing the high arsenic concentrations found, leading to the average reader's perception that

This report has done very little to allay the fears of concerned residents, or to convince them that they are being protected.

The ATSDR has taken the following steps to explain that there is no public health threat from the limited use of phosphate slag in buildings and roads:

a. *Met with individual homeowners on numerous occasions,*
b. *Held public meetings and availability sessions,*
c. *Coordinated with the EPA and the State of Florida Department of Health,*
d. *Responded to numerous letters and phone calls from the press, the public and elected officials,*
e. *Preparing public health education in conjunction with the State of Florida Department of Health.*

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION 4

SUPERFUND FACT SHEET

RESULTS OF EPA GAMMA RADIATION SURVEYS AND SAMPLING OF SLAG MATERIALS TAKEN IN THE TARPON SPRINGS AREA IN JUNE - AUGUST 1998

January 1999

In this Fact Sheet:

- *Purpose of Sampling for Radiation*
- *Previous sampling activities; sampling locations and results*
- *Criteria used for evaluating results*
- *Enforcement activities*
- *ATSDR Public Health Assessment*
- *Recommendations/conclusions*
- *Public Meeting/Public Involvement*

The U.S. Environmental Protection Agency (EPA) Region 4 conducted surveys and sampling for gamma radiation and non-radiological contaminants in Tarpon Springs, Florida and the surrounding counties in June, July, and August of 1998. These activities were requested by local residents who felt that contaminants may have been, distributed from the Stauffer Chemical Company Superfund site in Tarpon Springs (site) into the surrounding communities and may be adversely affecting their health. This fact sheet highlights EPA's sampling activities and summarizes a concurrent health assessment conducted by the Agency for Toxic Substances and Disease Registry (ATSDR). Also, the fact sheet provides interpretation of the results and, recommendations, and proposed dates for the public meeting.

PUBLIC MEETING

EPA will hold a public meeting to discuss the Offsite Sampling Results on January 28, 1999 at the Tarpon Springs High School from 6:30 until 7:30p.m. located at 1411 Gulf Road West, Tarpon Springs, Florida. Please read the information contained within this fact sheet, and prepared all questions in writing prior to the meeting in order to abide by the time-frame allotted by this facility.

INVESTIGATION BACKGROUND

Local residents expressed concerns that slag was transported from the Stauffer Chemical Company

(Tarpon Springs) site and used as a construction material in roads, driveways, houses, and other structures in the communities surrounding the site (offsite areas). The Stauffer Chemical Company and their predecessor manufactured elemental phosphorous from 1947 until 1981 using phosphate ore mined from deposits in Florida. A by-product of the elemental phosphorous production process was phosphate slag (slag). The rock-like slag material contains radium-226 and a host of metallic contaminants.

<u>Past Surveying/Sampling Activities - State of Florida</u>

The Florida Department of Environmental Protection (FDEP) and the Florida Department of Health, Bureau of Radiation Control (DOH-BRC) conducted gamma radiation surveys on roadways, driveways, and building interiors and analyzed 10 slag samples for the presence of nine non-radiological, site-related contaminants in July through December 1997. Based on these analyses, the Florida Department of Health prepared a health consultation which recommended no further action.

<u>EPA Region 4 Surveying and Sampling Activities</u>

At the request of the community, EPA agreed to expand the previous FDEP and DOH-BRC activities by conducting additional gamma radiation surveys, and collecting and evaluating additional samples of roads, driveways, yards, and home interiors in the City of Tarpon Springs and surrounding areas in Pinellas and Pasco Counties. The EPA conducted these activities in June through August 1998 as discussed below:

<u>June 25, 1998 Gamma Radiation Screening Surveys by EPA</u>

The EPA conducted gamma radiation screening surveys in two homes, four driveways, and three roadways, using a Ludlum Model 19 Micro R meter (Ludlum) to determine the best sampling locations. The Ludlum, which is calibrated to Cesium-137, provides a conservative result when surveying for Radium-226. EPA used the results of these surveys, combined with review of the previous DOH-BRC surveys and discussions with residents, as a basis for selecting locations for the July sampling event.

<u>July 7-10, 1998 Sampling Event by EPA</u>

The U.S. EPA's Science and Ecosystems Support Division, Athens, GA (SESD) collected 26 samples as shown in Table 1 (plus QA/QC and background samples) and shipped them to EPA's National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama for chemical and radiological analysis. The purpose of the analysis was to determine the presence and concentrations of site-related radiological and non-radiological contaminants in the samples. The site-related contaminants evaluated are discussed in the Results section below. In addition, the EPA sent two samples from the offsite areas and one sample from the site to the Idaho National Engineering and Environmental Laboratory (INEL) for visual and microscopic comparison. The purpose of this analysis was to determine whether the offsite slag materials could be scientifically "fingerprinted" to the Stauffer slag.

Table 1 - Sampling Locations July 7-10, 1998

Media	Number of Samples
Driveway Paving	4
Driveway Base	4
Road Paving	4
Road Base	4
Yard Soils	4
Slag Pile in Yard	1
Basement Slab on Grade	1
Basement Slab Base	1
Right of Way Paving	1
Right of Way Base	1
Stauffer Slag Pile	1

<u>August 23-26, 1998 Re-Surveying of Homes for Interior Gamma Dose</u>

During the gamma radiation screening surveys conducted by EPA using the Ludllum, it was determined that four homes exceeded interior gamma dose levels recommended by 40 CFR Part 192, the "Uranium Mill Tailings Act" (20 uR/hr + background). The EPA and NAREL conducted additional surveys in these homes using a Pressurized Ionization Chamber (PIC) and a Bicron Microrem Meter. The PIC and Bicron meter measure all radioisotopes and measure body tissue dose; their results are more realistic.

RESULTS

Slag and Soil Sampling

All samples were evaluated for dermal contact, incidental ingestion, and inhalation, as if the slag was soil. While the crumbling of slag roads and generation of dust was observed during the gamma survey and sampling events, the evaluation of all slag material as loose soil is highly conservative.

Carcinogens

Carcinogenic (cancer-causing) contaminants were evaluated in accordance with EPA's procedures for determining Total Lifetime Excess Cancer Risk (risk). EPA considers chemical concentrations posing a risk in excess of 1 in ten thousand (1×10^{-4}) to require further action. Soil in which the cumulative contaminant concentrations exceed the 1×10^{-4} risk (trigger concentration) would require EPA action. Table 2 provides a list of the site-related carcinogens evaluated, the maximum levels detected, trigger concentrations corresponding to the 1×10^{-4} risk, and the source of the trigger concentrations. Note that site-related carcinogenic polyaromatic hydrocarbons are not shown because they were not detected in the samples collected.

Table 2 - Site Related Carcinogens Detected in Offsite Areas - Maximum Concentrations

Contaminant	Maximum Concentration Detected	10^{-4} Trigger	Source
Arsenic	4.35 ppm	40 ppm	Site*
Ra-226 Ingestion	70.2 pCi/g	268 pCi/g	EPA Risk**
Ra-226 Inhalation	70.2 pCi/g	4807600 pCi/g	EPA Risk**

*EPA Region 4 does not consider arsenic in soil to be a carcinogen; however, it does consider arsenic to be a carcinogen in drinking water. If the assumption was made that arsenic is a carcinogen in soil, then the safe soil level for children would be a 10^{-6} risk level of 0.4 ppm; the 10-4 trigger would be 100 times higher, approximately 40 ppm.

** EPA calculated the trigger levels for ingestion and inhalation in accordance with the EPA's "Risk Assessment Guidance for Superfund."

The excess lifetime cancer risks due to all carcinogens from a given sample were added to determine if their combined effect exceeded the trigger of 1×10^{-4} for that sample. All samples were below the 1×10^{-4} trigger level.

Conclusion: The total excess lifetime cancer risk at all sample locations was below the 1×10^{-4} trigger .

Table 2 - Site Related Non-Carcinogens Detected In Offsite Areas - Maximum Concentrations			
Contaminant	Maximum Concentration Detected (ppm)	PRG (ppm)	Source
Aluminum	15400	75000	FAC
Antimony	0.896	26	FAC
Arsenic*	4.90	21	EPA
Barium**	155	5200	EPA
Beryllium	1.96	120	FAC
Cadmium	1.82	75	FAC
Chromium	48.8	290	FAC
Cobalt	7.55	4700	FAC
Copper**	549	2800	EPA
Iron	3500	23000	FAC
Lead	48	400	EPA
Manganese	157	1600	FAC
Mercury	0.0995	3.7	FAC
Nickel**	34.4	1500	EPA
Selenium	2	390	FAC
Silver	0.222	390	FAC
Thallium*	0.7	6	EPA
Vanadium**	26.8	520	EPA
Fluoride***	1300	3600	EPA
Zinc	400	23000	FAC

*The FAC does not provide PRGs for the non-carcinogenic effects of Arsenic or Thallium. EPA Region 4 Risk-based numbers were used. **The FAC PRGs for these chemicals are based upon an acute (one time) exposure to a large amount of ingested soil. EPA PRGs are based on long-term (chronic) exposure to a typical amount of soil that would be ingested by residential exposure. EPA believes the latter exposure scenario represents the appropriate basis for developing cleanup levels. ***Samples were not analyzed for Fluoride; the concentration shown is from a previous on-site slag sample.

Non-Carcinogens

Non-carcinogenic contaminants (toxic but not cancer-causing) were evaluated by comparing the contaminant concentrations detected in the samples with established Preliminary Remediation Goals (PRGs) for specific target organs (such as nervous system, skin, small intestine, etc). The contaminants evaluated, maximum levels detected, PRGs, and the source of the PRGs are shown in Table 3. Table 3 consists entirely of metals. Volatiles were not detected in any of the samples. For each sample location, the hazard quotients for each contaminant were added to determine if their cumulative effect exceeded the total allowable hazard associated with non-carcinogenic contaminants (Hazard Index). In one case, this Hazard Index was exceeded. However, upon comparing the individual hazard quotients to the PRGs for each target organ, it was determined that the levels were acceptable.

Conclusion: Non-carcinogenic contaminant concentrations are within acceptable levels at all locations.

Whole-Body Gamma Radiation Dose

Gamma Radiation Dose Screening Criteria

There are numerous maximum recommended radiation doses provided by several sources. These sources included the Florida Administrative Code (FAC), 40 CFR Part 192, National Council on Radiation Protection (NCRP), and Health Consultations issued by the ATSDR. Based upon the review of these screening criteria, the EPA selected the screening criteria for the analysis of the offsite areas as shown in Table 4. All readings were taken at waist level unless otherwise noted.

Table 4
Gamma Radiation Dose Screening Criteria

Location Type	Suggested Criteria	Source
Interior Residential	20 uR/hr[1]	40 CFR 192
Total Residential Property[2]	200 mRem/yr[1]	ATSDR Health Consult[4]
Roadway[3]	500 mRem/yr[1]	NCRP and FAC

[1] All levels shown do not include background.
[2] 18 hrs/day in house, 2 outdoors, 350 days per year
[3] Walking on road for 2 hours/day, 350 days/year
[4] ATSDR 1992 Health Consult, Austin Ave. Radiation Superfund Site

Residential Gamma Dose Surveys - Home Interiors

EPA Region 4 surveyed five residential interiors. As noted previously, four of those interiors exceeded the 20 uR/hr +background dose recommended by 40 CFR Part 192 when surveyed using the Ludlum. When re-surveyed using the PIC, only one home remained above the recommended interior dose. Table 5 shows the results for those homes re-surveyed using the PIC.

Table 5
Average Interior Gamma Doses Using PIC Including Background*

Residence	Room Surveyed	Interior Gamma Dose - PIC
1	Basement	40 uR/hr
1	First Floor	17 uR/hr
2	Master BR	24 uR/hr
3	Living Room	20 uR/hr
4	Garage/Shop	23 uR/hr

* Ave Background in Florida is uR/hr. The criteria including background is 20 uR/hr + 6 uR/hr = 26 uR/hr.

Conclusion: One home exceeds the recommended criteria for interior gamma dose of 26 uR/hr including Background.

Residential Gamma Dose Surveys - Driveways

EPA Region 4 surveyed five driveways. The results are shown in Table 6.

Table 6
Gamma Radiation Doses - Driveways

Driveway Location	Gamma Dose (uR/hr) (incl. Background)
1	45
2	40
3	23
4	180
5	140

Residential Gamma Dose Calculations - Total Property

Table 7 illustrates the total gamma radiation dose of five properties sampled.

Table 7 Total Property Gamma Radiation Dose (Excluding Background)			
Property	Interior Dose (mRem/yr)	Driveway Dose (mRem/yr)	Total Dose (mRem/yr)
1	205	28	233
2	87	13	100
3	59	122	181
4	0	94	94
5	114	24	138
6	107	Backgnd	107

Conclusion: One whole property exceeds the criteria established for this analysis in Table 4; that exceedance is due primarily to the interior gamma dose as shown in table 6. Residential driveways do not exceed the recommended criteria.

Gamma Radiation Dose Surveys -Roadways

EPA Region 4 surveyed four roadway locations. The hourly doses and calculated annual doses for three of the locations are provided in Table 8.

Table 8 Gamma Radiation Surveys Results and Calculated Annual Doses - Roadways			
Road Location	Hourly Dose Including Background	Hourly Dose Not Incl. Background	Annual Dose (mRem/yr)
1	190 uR/hr	184 uR/hr	129
2	180 uR/hr	174 uR/hr	122
3	190 uR/hr	184 uR/hr	129

Conclusion: None of the roadways sampled exceeded the recommended gamma radiation dose criteria of 500 mRem/yr.

Radon Sampling

EPA tested four home interiors for radon; all results were below the recommended 4 pCi/L level.

Conclusion: Phosphate slag is not producing unacceptable levels of radon inside of residences.

Enforcement Activities

EPA has verified through information provided by Stauffer Management Co., local citizens, and a national railroad company, that slag materials were taken from the site and used as construction material in offsite areas. The extent of distribution is unknown at this time.

In addition, EPA has determined that another plant in Nichols, FL manufactured elemental phosphorous using the same process, and distributed slag in the same manner as was done by Stauffer Chemical Company and its predecessor, in the same time period. The extent of distribution from this plant is also unknown. Additional potential sources of slag material may also exist.

Conclusion: Slag has been distributed by Stauffer Chemical Co., its predecessor. The extent of distribution is unknown. A similar elemental phosphorous plant in Nichols, Florida also distributed slag material.

Onsite vs. Offsite Slag Fingerprinting/Comparison

EPA Region 4 sent one sample from a residential basement concrete slab, one sample from a residential roadway, and one sample from the on-site slag field, collected during the July sampling event, to the Richard Smith, Consulting Scientist, Lockheed-Martin Idaho Technologies Co., Idaho National Engineering Laboratory, for visual and microscopic "fingerprinting." Dr. Smith indicated that the offsite samples were "visually indistinguishable" from the on-site slag sample.

Dr. Smith recommended that EPA Region 4 identify other, nearby plants that manufactured elemental phosphorous using the same process (such as the one in Nichols, FL and possibly others). If their source mines, manufacturing processes, and methods for cooling the slag were the same manner as was done at the Stauffer plant, then an in-depth geochemical comparison may be performed to distinguish between their respective slags. However, even a geochemical comparison is not a guarantee.

Conclusion: The materials sampled undoubtedly contain phosphate slag; however, the source has not been definitively determined.

ATSDR PUBLIC HEALTH ASSESSMENT

The ATSDR completed a public health assessment and will distributed it concurrently with EPA's distribution of this fact sheet. In summary, the ATSDR notes that there is a completed exposure pathway to ionizing radiation (radium-226) and heavy metals. However, they do not consider the presence of these contaminants in driveways, roadways, or yards to pose a public health threat. In addition only one home exceeds the recommended screening criteria for indoor gamma radiation. ATSDR recommends:

1) The resident of the one home limit time in the affected areas (primarily the basement).

2) Public health education be provided to assist the public in understanding that slag materials pose no public health hazard.

SUMMARY OF RESULTS

The following summary of results/conclusions can be applied only to the sampling locations evaluated. The sampling locations were "biased," based upon citizen requests and EPA identification of "hot spots."

Phosphate slag is present in the offsite area; however, the origin has not been definitively proven. At least one other plant exists in the area.

Roadways, Driveways, and Yard Soil: Gamma radiation doses, and radiological and non-radiological contaminant concentrations are elevated above background levels but are within the screening criteria established for this analysis.

Home Interiors: Several homes have shown elevated levels of gamma radiation doses; however, only one home exceeds the recommended criteria.

The ATSDR does not consider the offsite slag to pose a public health threat.

CONCLUSION

Based upon the information evaluated, combined with the surveys and analyses conducted by the FDEP, DOH-BRC, and the ATSDR, EPA has determined that no Superfund action is required in the offsite areas.

The Florida Department of Health is the governing authority over radiation in the state of Florida. They can address any concerns regarding radiation in your area.

SOURCES

State of Florida Administrative Code Section 64E-5.301

State of Florida Administrative Code Section 62-785

"Public Health Assessment, Stauffer Chemical Superfund Site Vicinity Properties, Tarpon Springs and Holiday, Florida," Agency for Toxic Substances and Disease Registry, Division of Health Assessment and consultation, December 1998

"Phosphorous Slag Identification in Construction Materials from the Tarpon Springs Area, Florida" Richard P. Smith, PhD, Lockheed-Martin Idaho Technologies Company, Revision 1, November 1, 1998

"Risk Assessment Guidance for Superfund Volume 1, Human Health Evaluation Manual (Part A), Interim Final," EPA/540/1-89-002, December 1989

"Risk Assessment Guidance for Superfund: Volume 1- Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals), Interim," U.S. EPA Publication 9285.7-01B, December 1991

"Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination," OSWER Directive 9200.4-18, August 1998

Letter dated February 5, 1992 from Robert C. Williams, P.E., Director, Division of Health Assessment and Consultation, to Mr. Charles Walters, Hazardous Waste Management, Agency for Toxic Substances and Disease Registry regarding EPA Region III activities at the Austin Avenue Radiation Sites in Landsdowne, PA

"A Citizen's Guide to Radon (Second Edition), The Guide to Protecting Yourself and Your Family from Radon," EPA Office of Air and Radiation, EPA Document No. 402-K92-001, May 1992

HOW DO I FIND OUT MORE?

EPA maintains an information repository at the Tarpon Springs Public Library which contains important documents about the Stauffer site:

Craig Park Branch
Springs Boulevard
Tarpon Springs, Florida 34689
(813) 942-5613

In addition, if you would like more information or have questions about the Stauffer site, please contact:

John Blanchard
or
Carlean Wakefield
U.S. Environmental Protection Agency
61 Forsyth Street, SW
Atlanta, Georgia 30303

1-(800) 435-9234

United States Environmental Protection Agency
Waste Management Division, SSMB
61 Forsyth Street, SW
Atlanta, Georgia, 30303

**INSIDE:
STAUFFER
TARPON SPRINGS
UPDATE**

Exposure Investigation

SODA SPRINGS INDUSTRIAL SITES

SODA SPRINGS, CARIBOU COUNTY, IDAHO

DECEMBER 16, 1998

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

EXPOSURE INVESTIGATION

SODA SPRINGS INDUSTRIAL SITES

SODA SPRINGS, CARIBOU COUNTY, IDAHO

Prepared by:

Exposure Investigation and Consultation Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

Purpose

Residents of a community in Soda Springs, Idaho contacted the Agency for Toxic Substances and Disease Registry (ATSDR) because of health concerns over possible exposure to hazardous substances from industrial operations near their neighborhood. The industrial facilities include the Solutia (formerly Monsanto) elemental phosphorous plant, the Kerr-McGee vanadium plant, the Evergreen Resources fertilizer plant, and the Soda Springs Phosphate fertilizer plant. Stack and fugitive emissions from these facilities may be impacting residents who live in the area.

In order to investigate potential public health hazards, information on possible environmental chemical contamination from industrial operations in the area is needed. To provide this information, ATSDR collected surface soil, subsurface soil, and indoor dust samples and analyzed them for chemicals known to be associated with the industrial operations in the area.

Background

The Solutia (Monsanto) and Kerr-McGee facilities are National Priorities List sites. Limited investigations at these sites identified metals, inorganic elements, and radio nuclides as being environmental contaminants of potential health concern [1,2]. The Soda Springs Phosphate plant reportedly uses slag, precipitator dust, and other waste materials from nearby industrial plants as source materials for phosphate fertilizer production. The Evergreen Resources fertilizer plant was not operating at the time of ATSDR's Exposure Investigation (August 25, 1998).

The petitioning residents live in a community located north of Soda Springs off Highway 34. The community is located about 1-mile southeast of the Solutia plant, 1-mile southwest of Kerr-McGee, and 1/2-mile south of Soda Springs Phosphate and Evergreen Resources. Residents of this community expressed concern over the possible health impact of particulate emissions from the stack at the Soda Springs Phosphate plant. The residents have observed brown-colored deposits on their homes, cars, on snow, and in rainwater collected from roof gutters.

The residents reported experiencing numerous health problems including breathing difficulties, coughing, loss of hair and teeth, allergies, depression, and cancer. In addition, they reported experiencing subjective symptoms such as eye and respiratory irritation.

Citizen Health Concerns

An ATSDR physician interviewed the residents to gather information about their health concerns.

Informed Consent

Prior to testing, an occupant of each home signed an informed consent form. The City Manager of Soda Springs gave ATSDR informed consent to collect samples from Corrigan Park and from the Soda Springs Industrial Park.

Results and Discussion

The concentrations of metals, inorganic elements, and radio nuclides detected in soil and dust samples are presented in Table 1. None of the soil or dust samples contained these contaminants at levels of health concern.

Sample 1BD was a brown-colored dust that was collected from the window sill of a residence located across the street from Soda Springs Industrial Park. The residents attributed this dust to particulate fallout from stack emissions from the Soda Springs Phosphate plant. They reported finding similar brown-colored deposits on their cars, on snow, and in rainwater from their roof gutters. The window sill dust sample contained the highest concentrations of cadmium, nickel, phosphorous, and vanadium that were detected in any of the soil or dust samples. These elements are present in waste and source materials from industrial operations in the area (1,2). However, to determine the origin of the window sill dust sample, it would be necessary to analyze particulate emissions from industrial stacks in the area. This task was beyond the scope of this investigation.

In general, the concentration of the metals and inorganic elements were higher in the dust samples than in soil samples from the same property. It has previously been reported that house dust tends to contain higher metal concentrations than soil from the same property (3,4). In addition, the house dust samples were filtered, and the fine particulate fraction was analyzed. Metal concentrations tend to be higher in fine dust particulates, as compared to coarse dust particulates (3,5).

The concentrations of fluoride were much higher in house dust samples than in the respective soil samples. This suggests that the fluoride originated from an unidentified source in the houses. Although elevated, the levels of fluoride detected in house dust do not pose a health hazard.

Follow-up Actions

ATSDR provided the participants a report that contained their test results and an explanation of their significance. The participants were invited to contact ATSDR if they had further questions concerning their test results. In addition, individual medical consultations were provided to participants with significant health concerns.

Kenneth G. Orloff

Kenneth Orloff, Ph.D., DABT

Peter J Kowalski

Peter Kowalski, CIH

David J. Hewitt

David Hewitt, MD

References

(1) Baseline human health and ecological risk assessments for Monsanto Chemical superfund site: Soda Springs, Idaho; prepared by Science Applications International Corporation for U.S. Environmental Protection Agency, Region 10; January 1995.

(2) Draft human health and ecological risk assessments for Kerr-McGee Chemical Corporation: Soda Springs, Idaho; prepared by Science Applications International Corporation for U.S. Environmental Protection Agency, Region 10; October 1993.

(3) Dennis J. Paustenbach, Brent Finley, and Thomas Long; The critical role of house dust in understanding the hazards posed by contaminated soil; Int. J. Toxicol 16 339-362 (1997).

(4) E. B. Culbard et al; Metal contamination in British urban dusts and soils; J Environ Qual 17 (2) 226-234 (1988).

(5) Michael J. Duggan and Michael J. Inskip; Childhood exposure to lead in surface dust and soil: A community health problem; Public Health Rev 13 1-54 (1985).

Attachment

Table 1: Metals, inorganic elements, and radionuclides in soil and dust samples. Metals and inorganics are reported as milligrams per kilogram (mg/kg); radionuclides are reported as picocuries per gram (pCi/g).

ID	Type	As	Be	Cd	Mb	Ni	P	V	F	^{226}Ra	^{238}U
1AS	soil	ND	1.2	16	5.8	23	7400	73	5.2	2.4	1.8
1ASS	soil	ND	0.63	11	ND	14	3400	43	3.7	1.3	0.9
1BS	soil	ND	1.2	7.1	ND	16	1800	37	4.6	-	-
1BSS	soil	ND	0.65	2.4	ND	16	1000	28	7.3	-	-
1AD	dust	ND	0.58	15	170	100	8900	170	1100	1.7	1.9
1BD	dust	ND	1.3	35	13	170	28000	320	250	-	-
1CD	dust	-	-	-	-	-	-	-	-	1.4	1.7
2S	soil	ND	1.3	4.9	5.7	16	2400	42	9.2	1.2	1.2
2SS	soil	ND	1.1	2.8	ND	16	1600	31	5.6	1.3	0.9
2D	dust	ND	0.86	11	ND	58	6300	120	1300	2.4	2.8
3S	soil	ND	1.6	9.2	ND	20	3400	60	5.3	2.1	1.3
3SS	soil	ND	0.23	7.3	ND	12	1600	12	3.0	1.4	0.9
3D	dust	ND	2.1	16	ND	72	11000	180	370	3.2	2.5
4S	soil	ND	0.77	2.5	ND	14	1300	28	8.6	3.5	4.2
4SS	soil	ND	1.0	ND	ND	12	730	27	4.5	3.4	3.9
4D	dust	ND	1.1	9.9	ND	47	5600	110	1600	0.1	2.0
5S	soil	ND	0.9	1.3	ND	9.6	1500	14	4.0	0.5	0.4
5SS	soil	ND	0.86	1.4	ND	10	1200	14	1.9	0.4	0.3
6S	soil	ND	1.6	17	ND	23	3400	71	9.1	1.7	1.5
6SS	soil	ND	1.2	ND	ND	14	860	34	4.2	1.0	0.8
CV	-	20	300	50	300	1000	-	350	3000	-	-

ID = sample identification number
1-4 = private residences
5 = Corrigan Park
6 = Soda Springs Industrial Park
S = surface soil (0-3 inches)
SS = subsurface soil (3-6 inches)
D = dust vacuumed from carpets, except sample 1BD, which was from a window sill, and sample 1CD, which was from a furnace filter
ND = not detected
CV = health-based Comparison Value; CVs were calculated using ATSDR's Minimum Risk Levels or EPA's Reference Doses and are based on a 10 kg child that ingests 200 mg of soil or dust per day. Phosphorus (as phosphate) is relatively non-toxic and no CV exists. No CVs are available for ^{226}Ra or ^{238}U, but the reported concentrations are within background levels for southeast Idaho.

Public Health Assessment for

PUBLIC HEALTH ASSESSMENT * ADDENDUM*
STAUFFER CHEMICAL COMPANY (TARPON SPRINGS)
TARPON SPRINGS, PINELLAS COUNTY, FLORIDA
CERCLIS NO. FLD010596013
AUGUST 6, 1999

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, is an agency of the U.S. Public Health Service. It was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by the EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of a health threat, if any, posed by a site and recommends ways to stop or reduce exposure in its public health action plan. ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by the EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible

TABLE OF CONTENTS

TABLES

BACKGROUND

In February 1998, the Agency for Toxic Substances and Disease Registry (ATSDR) received a petition from a Tarpon Springs, Florida, resident. The person requested that the agency investigate health problems that might be associated with exposure to slag materials used in residential areas of Tarpon Springs. Since then, the ATSDR has responded to letters from several other residents. The U.S. Environmental Protection Agency (EPA), Region IV also requested that the ATSDR review the sampling data taken at several vicinity properties near the Stauffer Superfund site in Tarpon Springs. The EPA asked the ATSDR to review chemical and radiological sampling data of residential slag, to evaluate exposure scenarios, to provide radiological dose estimates, and to make recommendations for protection of public health.

Since receiving letters from concerned Tarpon Springs residents, ATSDR staff members have begun investigating residents' health concerns and possible associations between those concerns and exposures to hazardous substances.

A. Site Description and History

From 1947 to 1981, the Stauffer Chemical Company (which operated under different ownership until 1960) made elemental phosphorus from phosphate ore using an arc furnace process. The processed ore was shipped off-site to produce agricultural products, food-grade phosphates, and flame retardants. While the chemical plant operated, waste products (i.e., slag) were disposed of on the plant property, shipped off-site by rail, and given to local residents to be used as fill and aggregate.

The Stauffer plant was added to the EPA Superfund list in 1994 because of pollution on the site. Superfund is a federal program for finding and cleaning up hazardous waste sites in this country. Since 1994, the EPA has been working to clean up the Stauffer site. The EPA is testing and monitoring the soil, water, and air at the site and at vicinity properties to protect nearby residents against health problems that might result from exposure to hazardous waste.

B. Site Visit

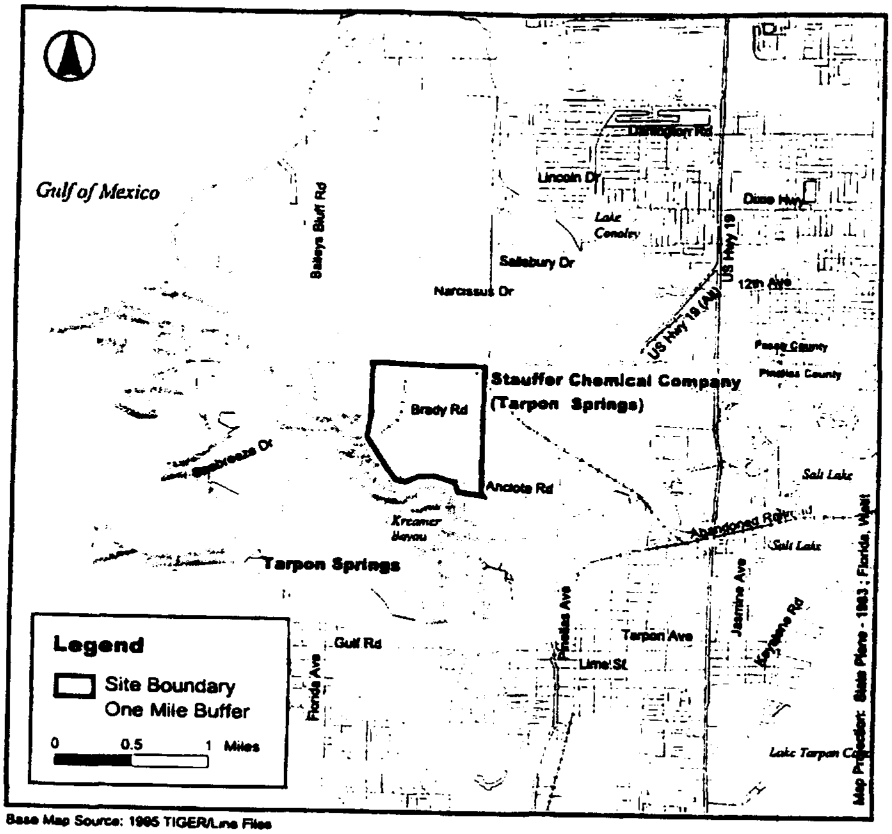
In May 1998, ATSDR staff members visited Tarpon Springs to meet with residents and to gather more information. Staff members addressed residents' questions. ATSDR and EPA Region IV personnel visited several vicinity properties in Tarpon Springs and Holiday, Florida. They saw the Stauffer Chemical Superfund site from the site boundary including the Anclote River. During a boat tour on the Anclote River, the ATSDR and the EPA were shown where slag from the site was used to fill in an inlet on site property.

In August 1998, EPA Region IV personnel and staff from EPA's National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, Alabama, took samples of building materials and roads and performed radiological surveys of several vicinity properties.

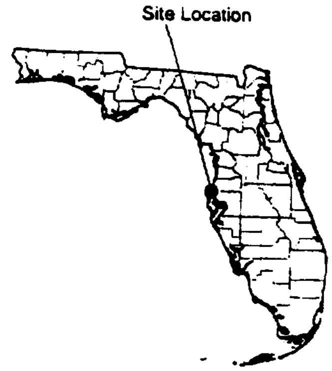
Stauffer Chemical Company (Tarpon Springs)

Tarpon Springs, Florida

CERCLIS No. FLD010596013



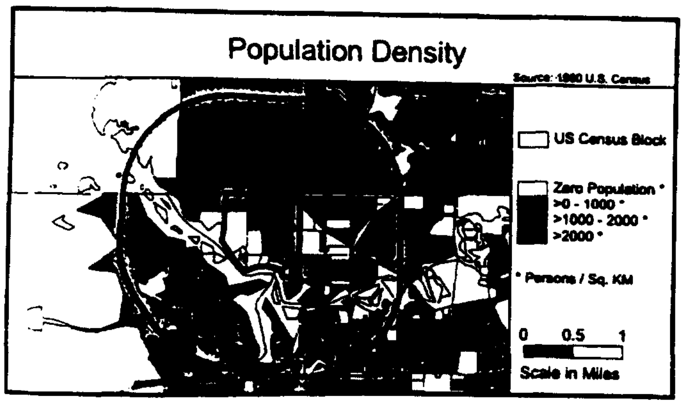
Base Map Source: 1995 TIGER/Line Files

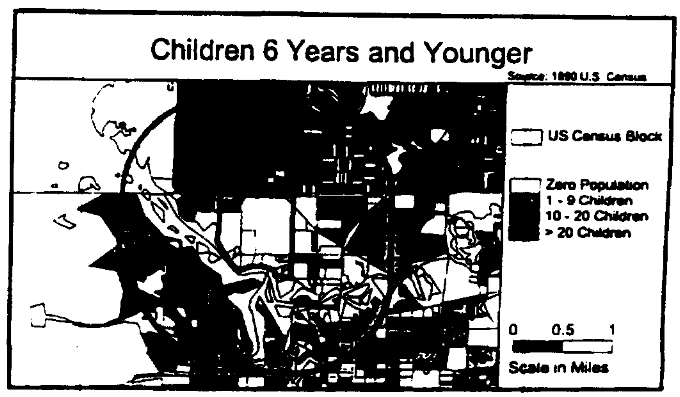


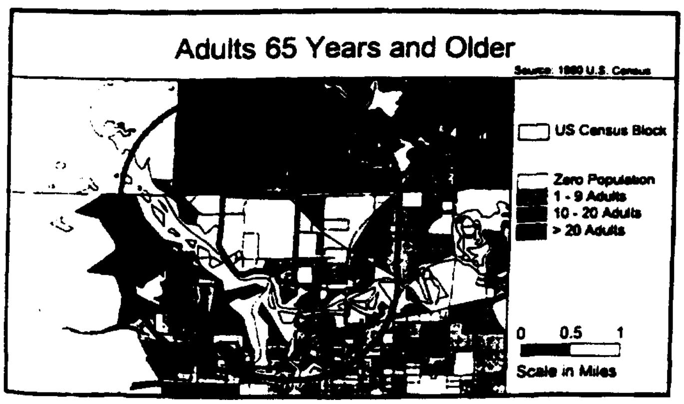
Pinellas County, Florida

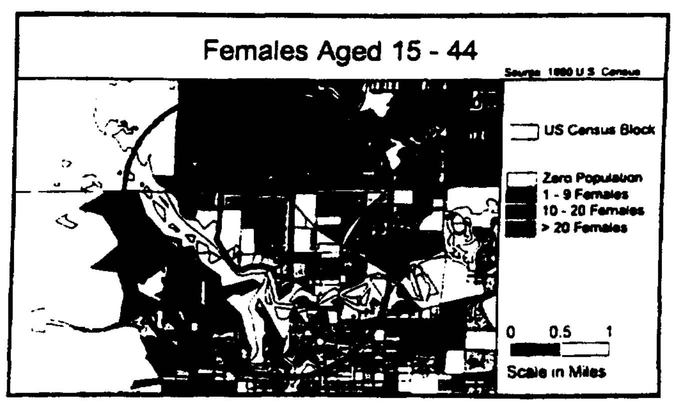
Demographic Statistics Within One Mile of Site*	
Total Population	9231
White	8936
Black	208
American Indian, Eskimo, Aleut	26
Asian or Pacific Islander	35
Other Race	23
Hispanic Origin	208
Children Aged 6 and Younger	549
Adults Aged 65 and Older	2940
Females Aged 15 - 44	1465
Total Housing Units	4906

Demographics Statistics Source: 1990 U.S. Census
*Calculated using an area-proportion spatial analysis technique









B. Quality Assurance and Quality Control

In preparing this public health assessment (PHA), the ATSDR relied on the information provided in the referenced documents. The agency assumed that adequate quality assurance and quality control measures were followed with regard to chain-of-authority, laboratory procedures, and data reporting. The validity of the analyses and the conclusions drawn in this document was determined by the availability and reliability of the referenced information.

PUBLIC HEALTH IMPLICATIONS

All the radium levels sampled at off site residences and the associated gamma radiation were elevated above the local average for background radiation. The National Council on Radiation Protection and Measurements (NCRP), in its report number 116 on page 50, states that some building materials can contain naturally occurring radioactive materials and should only be remediated if annual doses exceed 500 millirem per year (8). The lowest observed adverse effect level (LOAEL) from ionizing radiation is from 10,000 to 50,000 millirem in a short period of time (i.e., less than a week) and is seen as a slight decrease in blood cell count (7). (Note: A millirem is equivalent to a millirad for gamma radiation.)

Of the four homes sampled in the Tarpon Springs area, only one exceeded 100 millirem per year, from structural building materials. Residence #1 had elevated radiation levels, especially in the basement. Using a conservative scenario, the annual dose to a young child living in a basement bedroom could receive about 210 mrem/yr additional background dose, which is well below the NCRP's 500 mrem/yr guideline (8).

The ICRP and NCRP recommendations are very conservative and are a factor of 100 below the LOAEL for acute exposure to ionizing radiation. Even though the total dose including radon would be 310 mrem/yr, this is still roughly the national average background dose in the United States of 300 mrem/yr (9). No adverse health effects would be expected from residing in the most affected home.

Phosphate slag at sampled vicinity properties does not appear to contain sufficient heavy metals to represent a public health hazard, based on current medical, epidemiological and toxicological information. For non-radioactive chemicals and metals, the ATSDR uses comparison values (contaminant concentrations in specific media and for specific exposure routes believed to be without risk of adverse health effects) to select contaminants for further evaluation. The ATSDR and other agencies have developed the values to provide guidelines for estimating media contaminant concentrations that are not likely to cause adverse health effects, given a standard daily ingestion rate and standard body weight. Table 5 lists environmental media exposure guidelines (EMEGs) and reference media exposure guidelines (RMEGs).

Many of these values have been derived from animal studies. Health effects are related not only to the exposure dose, but to the route of entry into the body and the amount of chemical absorbed by the body. Several comparison values might be available for a specific contaminant. To protect the most sensitive segment of the population, the ATSDR generally selects the comparison value that uses the most conservative exposure assumptions.

Natural Background Radiation

Natural radiation and naturally occurring radioactive materials in the environment provide the major source of radiation exposure to the public. For this reason, natural background radiation is often used as a comparison for man-made sources of ionizing radiation. Background radiation comes from cosmic sources, naturally occurring radioactive materials including radon, and global fallout as it exists in the environment from testing of nuclear explosive devices. Although

CONCLUSIONS

1. Phosphate slag from the Stauffer Chemical Superfund site reportedly has been used as concrete aggregate in homes, roads and roadbeds in the Tarpon Springs and Holiday, Florida vicinity.

2. Although there is elevated background radiation from radium-containing slag and aggregate, the total background dose to a maximally exposed child in residence #1 is roughly the national average background dose of 300 mrem per year.

3. Annual background dose contribution from building materials to the maximally exposed child in residence #1 does not exceed the NCRP's recommended limit of 500 mrem per year.

4. Phosphate slag at sampled vicinity properties, does not appear to contain sufficient leachable heavy metals to represent a public health hazard, based on current medical, epidemiological and toxicological information.

5. Combined exposures from driveways and roads containing phosphate slag are not a health threat.

RECOMMENDATION

The ATSDR recommends that public health education be provided to help the public better understand that there is currently no general public health hazard posed by the phosphate slag and to provide information to community members on the environmental health effects presented in the Stauffer Chemical Vicinity Properties public health assessment addendum.

REFERENCES

1. Bureau of the Census, U.S. Department of Commerce, Washington, DC, 1990 Census Data Files.

2. Memorandum dated September 2, 1998, from Rick Button, Health Physicist to John Blanchard, Remedial Project Manager, US EPA. Report on radiological surveys conducted and observations for the offsite Stauffer Chemical visit of August, 1998 in Tarpon Springs, FL.

3. Memorandum dated September 17, 1998, from John Griggs, Chief Monitoring and Analytical Services Branch to John Blanchard, US EPA Region IV, Waste Division. Radiochemical results for Tarpon Springs Samples.

4. Florida Department of Health. Preliminary Public Health Assessment for Stauffer Chemical Company/Tarpon Springs, Tarpon Springs, Pinellas County, Florida. FDOH: Tallahassee, August 4, 1993.

5. Florida Department of Health, Bureau of Environmental Toxicology, Under Cooperative Agreement with the Agency for Toxic Substances and Disease Registry, Health Consultation for the Gulfside Elementary School, Holiday, Florida dated June 18, 1998.

6. ICRP (1990). International Commission on Radiological Protection (ICRP) Recommendations of the International Commission on Radiological Protection. ICRP Publication 60. New York: Pergamon Press. 1990.

7. National Council on Radiation Protection and Measurements. Influence of Dose and Its Distribution in Time on Dose-Response Relationships for Low-LET Radiations, NCRP Report No. 64. NCRP: Bethesda, 1980.

8. National Council on Radiation Protection and Measurements. Limitation of Exposure to Ionizing Radiation, NCRP Report No. 116. NCRP: Bethesda, March 31, 1993.

9. National Council on Radiation Protection and Measurements. Exposure of the Population in the United States and Canada from Natural Background Radiation, NCRP Report No. 94. NCRP: Bethesda, December 30, 1987.

10. National Council on Radiation Protection and Measurements. Ionizing Radiation Exposure of the Population in the United States, NCRP Report No. 93. NCRP: Bethesda, September 1, 1987.

Table 2 Stauffer Chemical Vicinity Properties - Residence 2

Location:	Residence 2	µrad/hr (waist level)
#1	bedroom	20
#2	bedroom	21
#3	bedroom	20
#4	bedroom	22
#5	bedroom	26
#6	bedroom	27
#7	bedroom	28
#8	bedroom	21
#9	bedroom	25
#10	bedroom	27
#11	bedroom	29
#12	bedroom	27
#13	bedroom	21
Annual Dose	from building materials	76 (mrem)

Note: One thousand microrad (µrad) are equivalent to one millirem (mrem) for gamma radiation. To calculate an Annual Dose, averaged the readings, then subtracted local background of 6 µrad/hr and assumed 12 hours per day in the bedroom and 5 hours in other parts of the house for 350 days per year.

Table 5 Maximum Contaminant Concentrations in Parts per Million (ppm)

Contaminant	Driveway Pavement	Driveway Base	Yard Soil	Comparison Value
Antimony	0.0566	0.252	0.0469	20 (Chronic RMEGs Child)
Arsenic	4.85	3.84	0.829	20 (Chronic RMEGS Child)
Beryllium	1.24	1.92	0.749	100 (Chronic RMEGS Child)
Chromium	27.7	22.3	49.6	200 (Chronic RMEGS Child)
Lead	18.2	11.7	31.8	400 (EPA Screening Level)
Thallium	0.70	0.614	0.0658	5 (Chronic RMEGS Child)
Vanadium	33.9	26.3	17.2	200 (Intermediate EMEG Child)
Radium-226	70.2 (pCi/g)	6.21 (pCi/g)	25.1 (pCi/g)	5 pCi/g to 5 cm depth 15 pCi/g below 5 cm (40 CFR 192)

Key: Reference Media Exposure Guideline (RMEGS)
Environmental Media Exposure Guideline (EMEG)
EPA Standards for Uranium and Thorium Mill Tailings {40 CFR 192 (1983)}
Code of Federal Regulations (CFR)

levels such as those which are estimated in this report. The ATSDR should also list the occupational dose limit of 5,000 mrem per year as a level considered safe for occupational radiation workers.

Converted all units discussed to millirem.

The report indicates that the PIC is calibrated in µrad per hour. It is my understanding that a PIC is designed to measure gamma radiation in air, which is properly measured with the unit Roentgens per hour or micro-Roentgens per hour. The rad describes the absorption of energy in tissue, not air, although the conversion from Roentgens to rads is simple. I do not, however, recommend the use of this unit since all the units in the report should be converted, as accurately as possible, to millirem to avoid confusion. However, my understanding of the definition of the Roentgen indicates that the statement of calibration of the PIC may be incorrect.

The PIC is calibrated using a NIST traceable standard, so that readings can be converted to µrad per hour. The chamber is constructed from a tissue equivalent material, so that readings are tissue equivalent and energy independent.

On page 7, the report refers to "high" concentrations of radium-226 in phosphate slag. From a radiation protection standpoint, the concentrations of radium-226 found in phosphate slag cannot be considered high since concentrations of radium-226 can be found in the natural environment which exceed these levels. A more appropriate characterization would be "elevated" such as was appropriately used at the top of page 8 and in other parts of the report.

Changed to "elevated", as suggested.

This report goes to great lengths to educate the public as to the potential radiation doses which might be received by persons who may be exposed to phosphate slag in their homes and in the environment. The ATSDR's use of the LOAEL provides a comparison which is easy to understand if it is listed in the same units. However, the ATSDR should inform the reader as to the proper use of the radiation protection guidelines which are referenced in the report.

Attempted to clarify the proper use of ICRP and NCRP guidelines.

Radioactive materials off-site appear similar to radioactive materials on the SMC site. The slag, regardless of where it occurs, has a low-- but elevated-- level of radioactivity. Simply put, the degree of danger from any radioactivity is directly proportional to the amount of slag nearby.

Slag contains naturally occurring radioactive materials, which is considered part of background. Doses did not exceed any applicable guideline.

Prior to these studies, it was thought there might be "hot spots" from particularly radioactive batches of slag. This would be difficult to determine on-site due to the enormous amounts of slag. However, off-site it could manifest as unusually radioactive driveways or foundations. Fortunately, these studies show this is not the case.

No change necessary.

The ATSDR does not feel further sampling is warranted, based on current sample results.

The most obvious shortcoming, of this health assessment is that the findings on which it is based are incomplete and standards are either absent, presented without explanation (Table 5), ignored or dismissed.

There are not always good or consistent guidelines available to make public health evaluations. The ATSDR strives to make public health evaluations of completed or potential exposures. If there is no exposure possible, then there is no health risk.

Mathematical projections of radiation exposure have been made, which may or may not approximate the actual exposure of affected individuals. This would be acceptable if there were no alternative way to collect experiential data. This is not the case, however. A sampling of affected residents needs to be given radioactivity-sensitive film badges to wear (over a period of time to be determined by the scientific community) to more accurately measure individual exposures. The local citizens deserve to be advised on the basis of information about what exposure is actually happening, rather than OD projections that do not take into consideration the life style of the individuals involved. Since techniques do exist to monitor the actual accumulation of exposure to radioactivity, and since the costs associated with that technique are not outrageously high, it seems to us that prudence would dictate that any scientist - and we assume that these results are being analyzed by scientists, not actuaries or risk managers- would not only recommend but urge that this extra step be taken to measure the actual, not the projected, exposure of the affected citizens.

Film badges would not be sensitive enough and tend to fade. The ATSDR would recommend that any homeowner interested in measuring their individual dose obtain a Thermo-Luminescent Dosimeter (TLD) from a local accredited lab.

The solubility, and thus the toxicity levels, of arsenic in offsite materials have not been investigated. The theory that arsenic is trapped and chemically/biologically unavailable is unsubstantiated. There have been no specific studies indicating that this is the case in any or all contaminated areas being included in these generalized conclusions. Pursuant to this lack of convincing data of the solubility of arsenic and other chemical contaminants, the questions relating to potential groundwater contamination have gone unasked and unanswered. Wells located in any areas with significant slag need to be tested for the contaminants of concern. The question of contaminated groundwater below contaminated offsite areas has been ignored.

EPA samples were leach tested for heavy metals including arsenic and the lack of measurable quantities of arsenic and other heavy metals in leachate demonstrate that the material is insoluble and therefore not bioavailable.

There appears to be no agreement on what standards for arsenic are acceptable. While local citizens were once led to believe that 10^{-6} risk levels for arsenic were to be applied as clean-up levels (.4 ppm or .8 ppm, depending on whether federal or state guidelines are referenced), this no longer seems to be the case. The PHA Draft itself makes no mention of the current disagreement over standards, and instead lists an RMEGS Comparison Value of 20, which has the affect of minimizing the high arsenic concentrations found, leading to the average reader's perception that

This report has done very little to allay the fears of concerned residents, or to convince them that they are being protected.

The ATSDR has taken the following steps to explain that there is no public health threat from the limited use of phosphate slag in buildings and roads:

a. *Met with individual homeowners on numerous occasions,*
b. *Held public meetings and availability sessions,*
c. *Coordinated with the EPA and the State of Florida Department of Health,*
d. *Responded to numerous letters and phone calls from the press, the public and elected officials,*
e. *Preparing public health education in conjunction with the State of Florida Department of Health.*

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION 4

SUPERFUND FACT SHEET

Tarpon Springs Community Slag Sampling and Other Offsite Issues

Stauffer Chemical Superfund Site
Tarpon Springs, Florida

December 1999

This fact sheet provides answers to frequently asked questions about the Tarpon Springs community slag sampling effort and other offsite issues.

A: ***Has slag from the phosphorous manufacturing process been distributed offsite? If so, how much was shipped, where was it shipped, and how was the slag used? Does the slag contain any site-related contamination?***

A: Slag has been used as an aggregate in concrete, road bases, paving, and other materials. EPA has no way of knowing how much slag was shipped or where it went. We know, however, that the slag contained levels of radium-226, arsenic, beryllium, and thallium above background, and that the slag was used to construct roads and structures in the Tarpon Springs area.

Q: ***Is slag from the site hazardous to people in the Tarpon Springs area?***

A: The U.S. Environmental Protection Agency (EPA), the Florida Department of Environmental Protection (FDEP), the Florida Bureau of Radiation Control, and the Agency for Toxic Substances and Disease Registry (ATSDR) evaluated slag materials and their potential impacts on the Tarpon Springs community in 1997 and 1998. The evaluation determined slag materials were in some homes and roads, but ATSDR determined these materials do not pose a threat to public health. In addition, recent radiation badge testing of 60 residents by the Pinellas County Health Department found the residents' radiation exposure was less than the national average.

Q: ***If the slag does not pose a public health threat in the community, why is that same material being cleaned up on the Stauffer site?***

A: The Stauffer site is being remediated to residential cleanup standards. For residential exposure, the EPA follows a regulation called the Uranium Mill Tailings Act (40 CFR 192). Under this regulation, the cleanup standard for a gamma radiation dose inside of a structure is 20 uR/hr + background. When evaluating the Stauffer site for residential standards, it was assumed that a resident could build a home directly on top of the slag field, which would result in a gamma radiation dose of up to 140 uR/hr. EPA did not find gamma radiation doses anywhere near that level in the homes we evaluated offsite. We found similar doses on the roads, but residents are exposed to roads only a fraction of the time that they spend in their homes. For more information, please call EPA Region 4 radiation specialists Rick Button at (404) 562-9135 or Jon Richards at (404) 562-8648

Q: ***When EPA conducted slag analysis in the community, the Agency conducted a risk assessment for ingestion and inhalation of slag materials, but did not do a risk calculation for the gamma radiation dose. Why not?***

A: EPA evaluates the inhalation and ingestion of chemical contaminants, including radionuclides, by comparing their concentrations to a background level and performing preliminary calculations to determine a theoretical excess lifetime cancer risk or toxicity posed to a person due to the presence of those contaminants. An excess lifetime cancer risk greater than one in 10,000 warrants further Superfund action. The assumptions used in this process are highly conservative.

In contrast, EPA evaluates whole body gamma radiation by measuring its dose and comparing it to a reference dose. EPA used the Uranium Mill Tailings Act (40 CFR Part 192), which provides a reference dose of 20 uR/hr + background for exposures inside of a structure. If the gamma dose exceeds the established reference dose, then EPA conducts an additional evaluation to determine whether Superfund action is needed. Such an evaluation may include analysis by ATSDR to determine whether the dose found poses a health threat. For a more detailed explanation of this process, please call EPA Region 4 radiation specialists Rick Button at (404) 562-9135 or Jon Richards at (404) 562-8648.

Q: ***Does slag in the community pose a radon threat?***

A: EPA provided radon test kits to several residents whose homes contained slag materials. Test results showed radon levels in these homes do not pose a health threat.

Q: ***Does the Stauffer site pose a risk to children at Gulfside Elementary School?***

A: EPA and ATSDR have collected soil, water, and air samples and conducted health assessments at the school. Sample results show **no** health threat at the school. In addition, Pasco County school board representatives have taken similar samples, with similar results.

Q: ***Are private wells in the upper aquifer? If so, are well users at risk from site related contamination?***

A: ATSDR conducted a health consultation on five offsite private wells, based on sampling results collected by Pinellas County. ATSDR has determined these wells do not pose a health threat to users.

Q: ***Have health assessments been conducted at public utilities that provide water from the Floridan aquifer?***

A: ATSDR is preparing a draft petitioned public health consult on the Holiday Utilities municipal water supply system in Pasco County. So far, ATSDR has concluded the well does not pose a public health threat to users. EPA is aware that more information needs to be collected from the Floridan aquifer.

Q: ***How do I find out more information?***

A: EPA has an information repository for the Stauffer site at the Craig Park Branch Library on Springs Boulevard in Tarpon Springs. If you would like more information, please contact the following EPA representatives for the Stauffer site:

John Blanchard, P.E., Remedial Project Manager
Carlean Wakefield, Community Involvement Coordinator

U.S. Environmental Protection Agency, Region 4
61 Forsyth Street, S.W.
Atlanta, GA 30303

Toll-Free: 1-800-435-9234

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION 4

SUPERFUND FACT SHEET

Other Stauffer Site Issues

Stauffer Chemical Superfund Site
Tarpon Springs, Florida

December 1999

This fact sheet provides answers to frequently asked questions about the Stauffer site.

Q: ***Claims have been made that 900 drums are buried onsite in the main pond areas. Has EPA investigated these claims? If so, what were the results?***

A: EPA investigated these claims during the remedial investigation. Stauffer drilled over 150 borings in pond areas and conducted geophysical studies using magnetometry. In addition, test pits were installed. Only remnants of several drums were found; no evidence of large-scale drum burial was found.

Q: ***Was the Stauffer Management Company involved in the manufacture of munitions at the site? If so, have munitions been found onsite?***

A: EPA has no evidence that munitions activities took place onsite.

Q: ***A Roy F. Weston Company laboratory was under investigation for tampering with laboratory data during the late 1980s. What was the outcome of this investigation? Has any data taken from the Stauffer site been sent to that laboratory?***

A: The EPA Office of the Inspector General investigated claims that the Roy F. Weston Company laboratory in Lionville, Pennsylvania, backdated some organic samples. Roy F. Weston settled with the EPA for $750,000, but never admitted any wrongdoing. In addition, the contaminants involved were organics, which are not a concern at the Stauffer site. The Stauffer site was not affected by this incident. Weston is no longer in the laboratory business.

Q: ***Are chemicals of concern at the site consistent with those found in the manufacture of elemental phosphorus?***

A. Target chemicals to be remediated at the Stauffer site include elemental phosphorus, arsenic, antimony, beryllium, thallium, radium-226, and total carcinogenic polycyclic aromatic hydrocarbons (CPAHs). EPA is satisfied these chemicals are consistent with the manufacture of elemental phosphorus and supporting operations. For example, EPA knows beryllium occurs naturally in soils and is produced as a byproduct of burning fuel oil. Radium-226 and antimony are natural components of mined phosphate ore. Thallium components are used in rodenticides, fungicides, pesticides, and mineral analyses. CPAHs are formed through the incomplete burning of coal, oil, and gas and can be associated with the site. Operations such as these reasonably can be expected to have occurred at a manufacturing facility, such as the Stauffer facility. Arsenic has been found at elevated levels at five other elemental phosphorous producing plants around the country.

Q. ***How does EPA determine past site uses? If EPA cannot determine all past uses, how are chemicals onsite identified?***

A. When EPA investigates a site, every attempt is made through property searches to determine past site uses. In some cases, we cannot determine all past uses. Because of this uncertainty, EPA conducts sampling for the Target Analyte List and Target Compound List at all Superfund sites. At the Stauffer site, we also conducted sampling and analysis for all radionuclides. Through these activities, we can determine contaminants present at a site.

Q: ***EPA sampled the Anclote River on several occasions and came up with different results. Why did that happen?***

A: During initial site investigation activities, an EPA contractor skimmed a sample from the surface of the river, evaluated it, and stated that elevated levels of contaminants may be in the river. The proper method for collecting river samples is to collect a column of water. When we used water column sampling during the RI/FS, we did not find any elevated levels of site-related contaminants.

Q: ***Can the EPA modify a signed consent decree (CD)? If so, what is the process?***

A: Yes, EPA can modify/reopen a consent decree if site conditions warrant it, and the necessary changes are out of the scope of the existing consent decree. If this situation arose at the Stauffer site, EPA and Stauffer would negotiate an amendment to the consent decree, which would be processed through the Department of Justice and lodged in Federal Court. The community would be given an opportunity to comment on the proposed change.

Q: ***Recent sampling of several groundwater wells in Pasco County showed elevated levels of thallium. Can these elevated levels be attributed to the Stauffer site?***

A: We have no proof that these elevated levels are attributable to the Stauffer site. Thallium and its components are used as rodenticides, fungicides, and pesticides; the elevated levels could be attributed to the use of these materials near the wells. In addition, these wells are several miles upgradient of the site.

Q: ***Have elevated levels of radon been found in drinking water wells? If so, what are those levels? How do they compare to EPA standards?***

A: EPA does not regulate radon in drinking water. Maximum radon concentrations found in drinking water were around 4,000 picocuries per liter (pCi/L). The State of Florida regulates radon in drinking water above 30,000 pCi/L. In addition, levels of radon have been found in background wells around the site.

Q: ***Has the site been sampled for asbestos? If so, what were the results?***

A: Site surface soils have been sampled for asbestos. Asbestos was detected in only one sample taken on the parking lot. The asbestos in this sample was below cleanup standards. EPA suspects the asbestos came from automotive debris (asbestos brake linings).

Q: ***Are the banks of Meyers' Cove eroding? Is this posing a hazard to marine life in the Cove and Anclote River?***

A: Based on our visual inspection and reports from nearby residents, EPA thinks that the banks of Meyers' Cove are eroding. We understand this may be due to wakes created by large boat traffic. EPA does not think the erosion poses a danger to aquatic life in the river at this time. We will do confirmatory sampling in and around the cove during and after site remediation. The remedial design will address the shoreline of the Anclote River and Meyers' Cove.

Q: ***How many studies have been conducted at the Stauffer site?***

A: At least 19 studies have been conducted at the site. These studies evaluated groundwater, river water, sediments, soils, and conditions at Gulfside Elementary School. They also included various treatability studies.

Q: ***How do I find out more information?***

A: EPA has an information repository for the Stauffer site at the Craig Park Branch Library on Springs Boulevard in Tarpon Springs. If you would like more information, please contact the following EPA representatives for the Stauffer site:

John Blanchard, P.E. Remedial Project Manager
Carlean Wakefield, Community Involvement Coordinator

U.S. Environmental Protection Agency, Region 4
61 Forsyth Street, S.W.
Atlanta, GA 30303

Toll-Free: 1-800-435-9234

THE UNDERSIGNED PARTIES enter into this Consent Decree in the matter of United States v. Atkemix Thirty-Seven, Inc. and Rhone-Poulenc Ag Company, Inc., relating to the Stauffer Chemical Superfund Site, in Tarpon Springs, Florida.

FOR THE UNITED STATES OF AMERICA

____
Joel M. Gross, Chief
Environmental Enforcement Section
Environment and Natural Resources
Division
U.S. Department of Justice
Washington, D.C. 20530

____
Rhonda Mims
Environmental Enforcement Section
Environment and Natural Resources
Division
U.S. Department of Justice
Washington, D.C. 20530

Charles R. Wilson
United States Attorney

By: ______________________

Assistant U.S. Attorney
Chief, Civil Division
Florida Bar No.______________
Address: ______________
____
____
Tel: ______________
Fax: ______________

Richard Green, Director
Waste Management Division
U.S. EPA Region 4
Atlanta Federal Center
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-8909

for

Michelle S. Staes
Assistant Regional Counsel
U.S. EPA Region 4
Atlanta Federal Center
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-8909

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of United States v. Atkemix Thirty-Seven, Inc. and Rhone Poulenc Ag Company, Inc., relating to the Stauffer Chemical Superfund Site, in Tarpon Springs, Florida.

Date: ________

For

mpk Brian S. Spiller
President, Stauffer Management Company
P.O. Box 15438
Wilmington, DE 19850-5438

Authorized to execute this Consent Decree on behalf of Atkemix Thirty-Seven, Inc. a wholly owned subsidiary of Stauffer Management Company.

Agent Authorized to Accept Service on Behalf of above-signed Party:

Name:	Michael P. Kelly
Title:	Attorney
Address:	Stauffer Management Company Wilmington, DE 19850
Phone:	(302)886-3851

THE UNDERSIGNED PARTY enters into this Consent Decree in the matter of United States v. Atkemix Thirty-Seven, Inc. and Rhone-Poulenc Ag Company, Inc., relating to the Stauffer Chemical Superfund Site, in Tarpon Springs, Florida.

Date: ____________

For

mpk Name: Brian S. Spiller
Title: President
Company Name and Address: Stauffer Management Company
as agent for Rhone Poulenc Ag Company, Inc.

Authorized to execute this Consent Decree on behalf of Rhone-Poulnec Ag Company, Inc., the corporate successor of Stauffer Chemical Company.

Agent Authorized to Accept Service on Behalf of above-signed Party:

Name:
Title:
Address:
Phone:

Stauffer Chemical Superfund Site Update

Presented by

John Blanchard, P.E.
Remedial Project Manager, U.S. EPA, Region 4
and
Joe Lafornara, Emergency Response Team,
U.S. EPA, Region 2

December 2, 1999

Presentation Topics

- Site Description/Cleanup Status
- EPA Community Support
- Shattuck Concerns
- Shattuck/Shauffer Comparison

Site Description

- 130 acres along Anclote River and Meyers' Cove
- Mixed industrial/residential area
- Elemental phosphorus manufactured onsite from 1947 to 1981
- Byproducts: arsenic, antimony, beryllium, thallium, radium-226

Site Cleanup Status

- NPL listing—1994
- RI/FS completed—1996
- 50,000 gallons of elemental phosphorus removed—1997
- Source materials cleanup plan (ROD)—1998
  - Limited excavation
  - Consolidation of excavated materials onsite
  - In-situ solidification/stabilization
  - Institutional controls

Site Cleanup Status (Continued)

- **EPA and Stauffer have completed at least 19 studies**
  - Soils, pond materials, sediments, surface water, ground water
  - Offsite evaluations
  - Treatability studies
- **Groundwater—future action**

Site Cleanup Status (Continued)

- **EPA and Stauffer signed Consent Decree (CD) in August 1999**
- **Dept. of Justice lodged CD in Federal District Court on November 24, 1999**
- **30-day public comment period for CD**
- **Schedule: design—about 10 months; construction—about 2 years**

EPA Community Support

- To date, at least 8 public meetings
- Onsite asbestos sampling
- Magnetic survey for buried drums
- Resident relocation

EPA Community Support (Continued)

- Slag evaluation near/in Tarpon Springs
- Meetings in residents' homes to discuss offsite analysis
- Meyers' Cove sampling

EPA Community Support (Continued)

- Hydrogeologist hired to review/recommend groundwater approach
- 1996 TAG
- 1996 community advisory group effort
- TOSC program support

Shattuck/Stauffer Community Concerns

- Shattuck/Stauffer Comparison
- Summary of Shattuck Issues
- Lessons Learned

Summary of Shattuck Issues

- Draft 5-Yr review report—no evidence of remedy failure
- No procedures in remedy design to assess failure
- Question is whether Shattuck remedy will be effective long term
- Issue is not technology, but design and construction methods

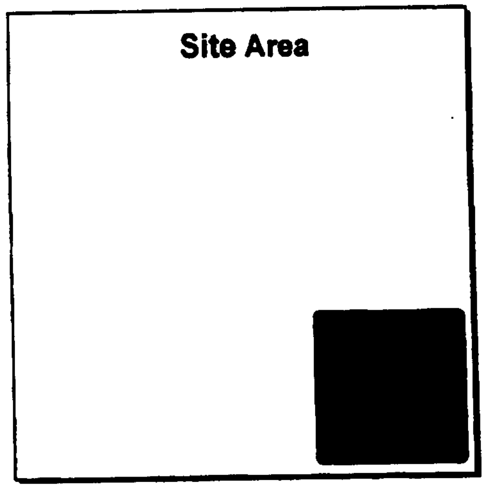
Lessons Learned at Shattuck

- Lack of institutional controls
- Design vulnerability to degradation
- Deficiencies in
  - Monolith monitoring plan
  - Plume monitoring plan
  - Site characterization and modeling
  - Risk assessment

Stauffer

130 acres

300,000 CY waste



Shattuck

6 acres

58,000 CY waste

Shattuck/Stauffer Comparison (Continued)

- **Site operations**
  - **Shattuck:** processed radium slurry, spent uranium, uranium mill tailings
  - **Stauffer:** manufactured elemental phosphorus from naturally occurring phosphate ore

Shattuck/Stauffer Comparison (Continued)

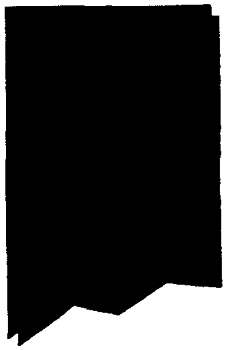
- **Contaminants of concern**
  - **Shattuck:** molybdenum, Ra-226, thorium, uranium, arsenic, beryllium, selenium, lead
  - **Stauffer:** Ra-226, elemental phosphorus, arsenic, beryllium, thallium, total PAHs, antimony

Shattuck/Stauffer Comparison (Continued)

- **Primary form of radionuclides**
  - Shattuck: soil
    loose, disperses easily
  - Stauffer: predominantly slag
    bound, hard to disperse

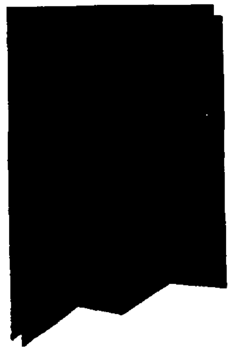
Primary Form of Radionuclides

Shattuck



- loose in soil
- disperses easily

Stauffer

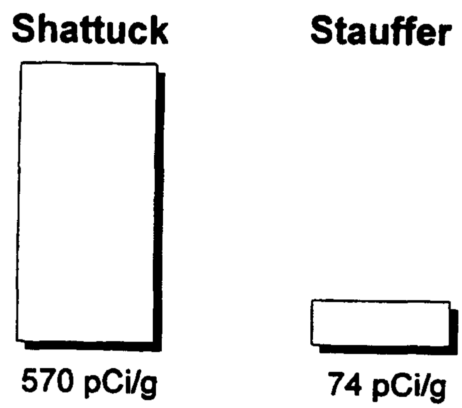


- bound in slag
- hard to disperse

Shattuck/Stauffer Comparison (Continued)

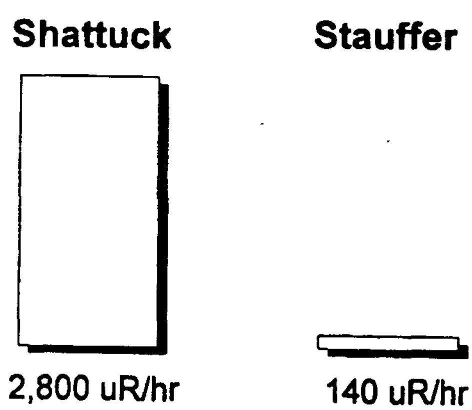
- **Radium concentrations/doses detected (max)**
  - Shattuck:
    - 570 pCi/g
    - 2,800 uR/hr
  - Stauffer:
    - 73.8 pCi/g
    - 140 uR/hr

Shattuck/Stauffer Comparison (Continued)



Radium equivalent concentrations (max.)

Shattuck/Stauffer Comparison (Continued)



Radium equivalent doses (max.)

Shattuck/Stauffer Comparison (Continued)

- **Other differences**
  - Site status
    - **Shattuck**: remedy complete
    - **Stauffer**: ROD and CD signed

Shattuck/Stauffer Comparison Summary

- **Major differences between sites**
  - Site size, waste volume, operations
  - Contaminants of concern, form of radionuclides
  - Radium concentrations/doses detected
  - Site cleanup status

Stauffer Remedy Design

Community will be invited to review design through PiPaTAG.

EPA will work with experts to design remedy.

EPA is fully committed to a protective remedy.

If design changes are needed to make the remedy protective, EPA will make necessary changes.

Conclusion

EPA is committed to working with the community surrounding the Stauffer site to design and construct a remedy that addresses community concerns and protects human health and the environment.

Exh. 8

APPENDIX A

Record of Decision

The Decision Summary
Operable Unit 1

Stauffer Chemical Tarpon Springs Site
Tarpon Springs, Pinellas County, Florida

Prepared By:
U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

RECORD OF DECISION

DECLARATION

SITE NAME AND LOCATION

Stauffer Chemical Tarpon Springs Site
Tarpon Springs, Pinellas County, Florida

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Operable Unit 1 at the Stauffer Chemical Tarpon Springs Site in Tarpon Springs, Pinellas County, Florida, which was chosen in accordance with the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments Reauthorization Act of 1986 (SARA), 42 U.S.C. § 9601 et seq., and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision is based on the Administrative Record file for this site.

The State of Florida, as represented by the Department of Environmental Protection (FDEP), has been the support agency during the Remedial Investigation/Feasibility Study process for the Stauffer site In accordance with 40 CFR § 300.430, FDEP, as the support agency, has provided input durin ; this process. Based upon comments received from FDEP, it is expected that concurrenc.e will be forthcoming; however, a formal letter of concurrence has not yet been received.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in the Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

This is the first of two operable units planned for the Site. This operable unit addresses the source of the soil and groundwater contamination by treating and containing the source material. The second operable unit will address the contaminated groundwater in the surficial aquifer. The diesel fuel product identified during the groundwater investigation will be addressed under the State of Florida's Underground Storage Tank Program.

The major components of the selected remedy include:

- Limited excavation of radiologically and chemically contaminated material/soil which exceed Residential Cleanup Standards.

- Consolidation of contaminated material/soil in the main pond area, slag area, and/or other areas on-site. Top Cover Caps which meet the Florida Administrative Code § 62-701.050 will be placed over the Consolidation Areas. The movement of contaminated soil/waste will be limited to minimize the generation of fugitive dust and to prevent the creation of additional threats to human health and the environment.

- Institutional Controls must be placed on the site. Institutional controls must include deed restrictions, land use ordinances, physical barriers, and water supply well permitting prohibitions. These restrictions will limit access to the site and prohibit the disturbance of the remedy.

- In-situ Solidification/Stabilization of pond material and contaminated soil below the water table will be required in the consolidation areas on-site. The consolidation areas will be delineated in the Remedial Design Report.

The total present worth cost for the selected remedy as presented in the Feasibility Study is $9,356,000. The construction of multiple consolidation areas may increase the present worth cost of this remedy.

STATUTORY DETERMINATION

The selected remedy is protective of human health and the environment, is cost effective, and it complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces the toxicity, mobility, or volume as a principal element.

Because this remedy will result in hazardous source material remaining on-site above health-based levels, a review will be conducted within five years after the commencement of remedial action and every five years thereafter to ensure the remedy continues to provide adequate protection of human health and the environment.

Richard D. Green 2 JUL 98

RICHARD D. GREEN DATE
WASTE DIVISION
DIRECTOR

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 SITE LOCATION AND DESCRIPTION

The Stauffer Chemical Tarpon Springs Superfund Site (Site) is located on Anclote Road in Tarpon Springs, Pinellas County, Florida. The location of the Site, taken from the U.S. Geological Survey (USGS) Topographic Map prepared in 1987, is presented in Figure 1-1 (not to scale). The Site is situated along the Anclote River, which flows into the Gulf of Mexico approximately two miles downstream of the Site. The town of Tarpon Springs is located approximately 2 miles southeast of the Site. The Site comprises an area of approximately 130 acres and includes the former phosphate processing area, elemental phosphorus production facilities, and office/administrative buildings. While operating, the plant utilized a system of seventeen waste ponds on-Site. Currently, these unlined ponds contain waste and no water. Land use in the surrounding area includes light industrial, commercial, and residential. Also, there are some undeveloped areas near the Site. The Site is generally flat with an average elevation of 10 ft above sea level.

The most significant surface water bodies near the Tarpon Springs Site are the Anclote River which is located along the Site's southern and western boundaries and the Gulf of Mexico which is approximately 2 miles from the Site. Pinellas County and the Site are underlain by two primary aquifers, the surficial aquifer and the Floridan aquifer. The depth to the surficial aquifer groundwater is relatively shallow. The thin nature of the surficial aquifer limits its usefulness as a drinking water supply; however, the aquifer provides water for irrigation purposes. The surficial aquifer is separated from the Floridan aquifer by a semi-confining, relatively continuous bed of clay to sandy clay. The Floridan aquifer, consisting of a thick sequence of carbonate (limestone) rocks which are hydraulically connected, provides most of the public water supply for Pinellas County. There are no active residential, or commercial wells either on-Site or between the Site and the Anclote River; therefore, there are no groundwater users on-Site or downgradient of the Site.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Stauffer Chemical Company Tarpon Springs Plant (the "Plant") produced elemental phosphorus using phosphate ore mined from deposits in Florida. The Plant was originally constructed and operated by the Victor Chemical Company, which began production in 1947. Stauffer Chemical Company obtained the Plant from Victor Chemical in 1960 and operated it until shutdown of operations in 1981. In 1983, the decision was made to decommission and dismantle the Plant permanently. Most of the Plant's former process buildings have since been dismantled. In 1987, the Stauffer Management Company (SMC) was formed as a result of a divestiture of the Stauffer Chemical Company.

In the February 1992 Federal Registry Notice, the Stauffer Chemical/Tarpon Springs Site was proposed for listing on the National Priorities List (NPL) by the United States Environmental Protection Agency (U.S. EPA). On July 28, 1992, SMC voluntarily entered into an

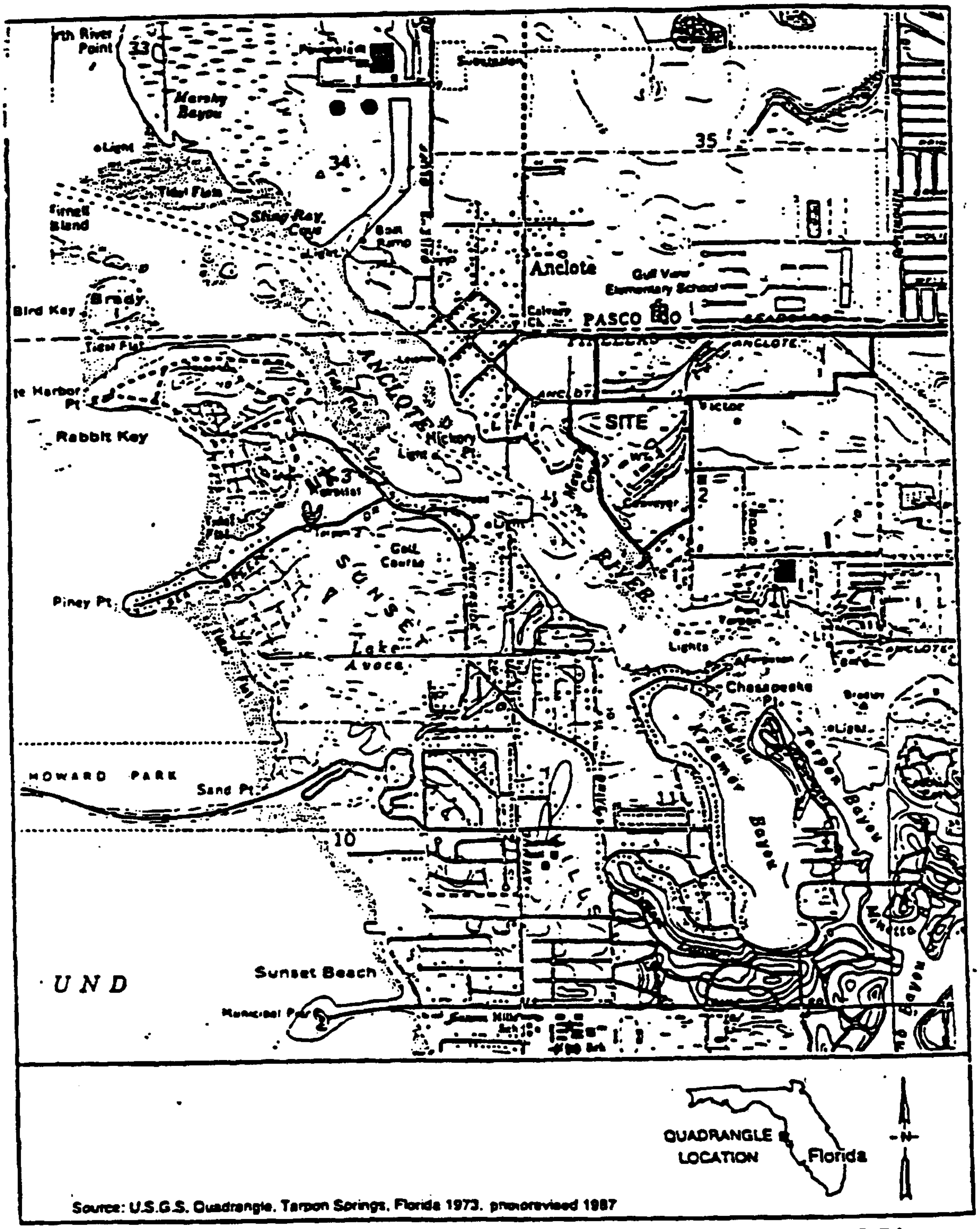


FIGURE 1-1 GEOGRAPHIC LOCATION MAP, SMC TARPON SPRINGS, FLORIDA

Figure 1-1

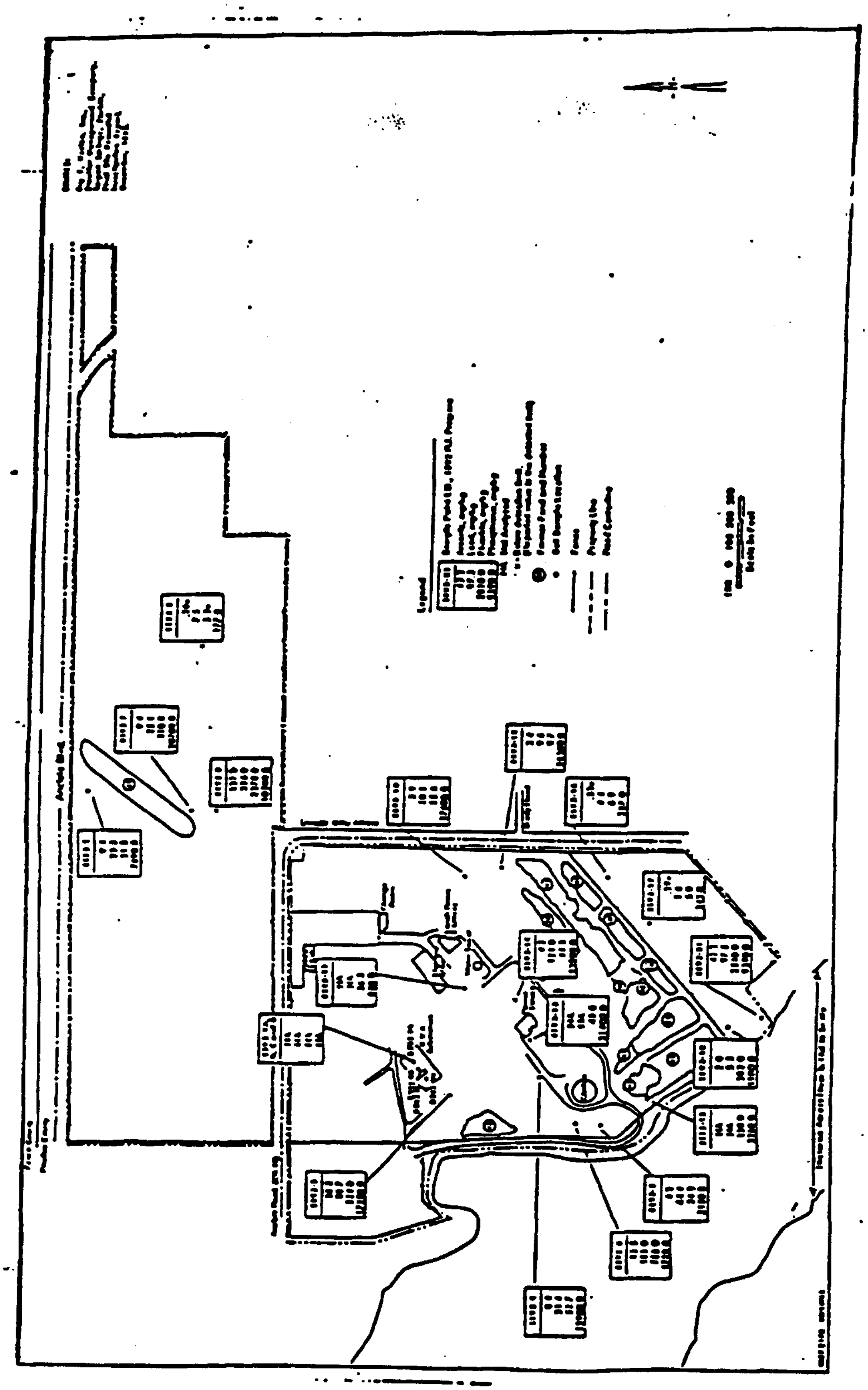


Figure 2-1
Page 3 of 57

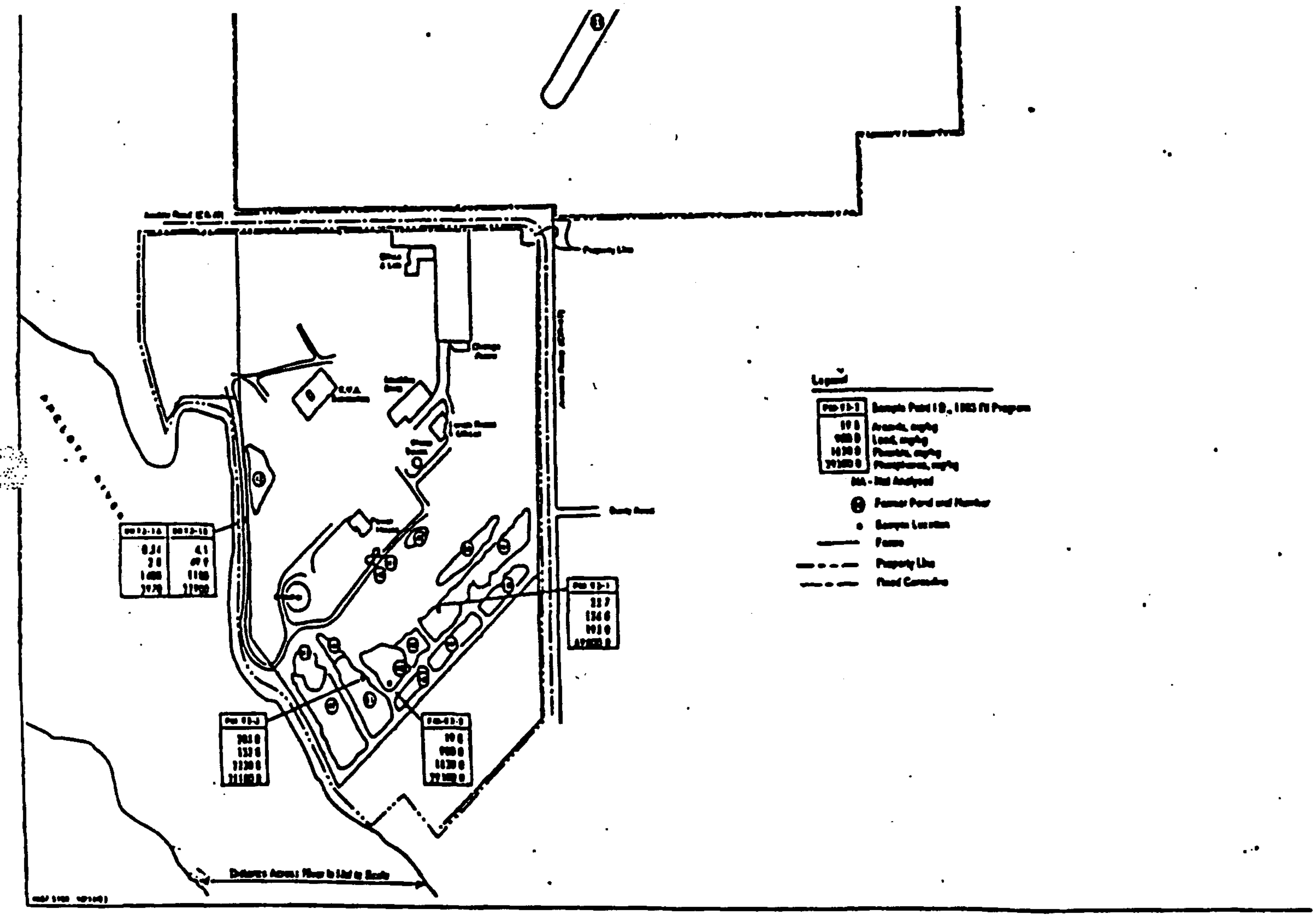


Figure 2-2
Page 4 of 57

Administrative Order on Consent (Consent Order) with U.S. EPA Region 4 (EPA), which requires the performance of a Remedial Investigation and Feasibility Study (RI/FS). The RI and FS final reports were completed and approved in March of 1996.

Several field investigations by various consultants were conducted at the Site. These investigations began with sampling of on-Site groundwater wells in 1974. Beginning in 1987, additional, multi-media investigations were conducted by various parties. To the extent possible, the studies were utilized in the Remedial Investigation

In addition to the RI field activities, a Contamination Assessment (CA) investigation was conducted at the Site in 1993. The CA was performed for the Florida Department of Environmental Protection (FDEP) in response to reported soil and groundwater contamination in the vicinity of two former above ground fuel oil storage tanks removed in August 1992. The cleanup of these areas in a coordinated approach with this operable unit will proceed under the State of Florida's Underground Storage Tanks Program.

Black & Veatch Waste Science and Technology Corporation (BVWST), under contract with EPA), prepared the Final Baseline Risk Assessment (dated May 18, 1994) for the Site. EPA issued Addendum I (dated June 10, 1994) to revise the Final Baseline Risk Assessment acknowledging the conservative nature of the assumption that all Phosphorus present was considered to be the most toxic Phosphorus (Elemental Phosphorus). In response to this addendum , additional samples were collected and analyzed by Roy F. Weston Incorporated, the SMC's consultant in September of 1996. The purpose of this sampling event was to confirm presence or absence of Elemental Phosphorus in Site media. EPA was present to oversee this sampling event. Based on the results of the Phosphorus Sampling Program conducted by WESTON, EPA issued Addendum II - Elemental Phosphorus and Diesel (February 2, 1996). Also, EPA presented Addendum IIA - Elemental Phosphorus in Surface Water and Sediment on February 22, 1995. Based on the confirmed absence or presence of Elemental Phosphorus in discrete samples collect in each Site media, the risk assessment was revised to re-evaluated risk levels in Site media. As a result of this additional work, the Final Revised Baseline Risk Assessment was issued by EPA on July 21, 1995.

The Feasibility Study (FS) was prepared by WESTON in accordance with the Consent Order. EPA reviewed and approved this FS. As part of the FS, an assessment of the environmental impact created by the Site was performed through a comparison of the concentration of contaminants at the Site with federal and state Applicable or Relevant and Appropriate Requirements (ARARs) and Site-specific criteria developed in the Baseline Risk Assessment.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

All basic requirements for public participation under CERCLA Sections 113(k)(2)(B)(I-V) and 117 were met in the remedy selection process. The first fact sheet on the Site was distributed in February 1993. Since that time, a community relations plan was developed and implemented at the Site. An information repository was established in March 1993, at the Craig Park Branch of the Pinellas County Public Library, Spring Street, Tarpon Springs, Florida. The Remedial Investigation (December 1993), the Revised Final Baseline Risk Assessment (July 1995), Feasibility Study (January 1996) and the Proposed Plan (March 1996) were released to the public and continue to be available for public review. These documents have been incorporated in the Administrative Record for the Site. A copy of the Administrative Record, upon which the remedy is based, is available to the public at the information repository. In addition, the Administrative Record and the Site files are available for review at the EPA Region 4 offices in Atlanta, Georgia. Notices of the availability of these documents were published in the Tampa Tribune and the St. Petersburg Times on May 26, 27, and 29 of 1996.

On May 29, 1996, EPA presented its preferred remedy for the Stauffer Chemical Tarpon Springs Superfund Site during a public meeting at the Gulfside Elementary School, Holiday, Florida. At this meeting, representatives of EPA answered questions about the sampling at the Site and the remedial alternatives under consideration.

A 90-day public comment period was held from May 29, 1996, through August 29, 1996. At the request of the public, this comment period was extended for an additional 30 days. The public comment period concluded on September 30, 1996. EPA's response to comments which were received during the comment period are contained in Appendix A of the Record of Decision.

4.0 SCOPE AND ROLE OF ACTION

The ROD selects the remedy for the first of two operable units. This ROD addresses the cleanup of heavy metals and radiation in soil and waste at the Site. Contaminants pose a risk to human health and to environmental receptors. The purpose of this proposed action is to prevent current or future exposure to contamination and to control the source of contamination. Groundwater will be addressed in a subsequent operable unit.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 Physiography and Topography

The terrain at and surrounding the Site is generally flat with an average elevation of 10 feet above sea level. There is a slight slope to the south toward the Anclote River. The Site is sparsely wooded in the north and northeastern areas, but is clear of vegetation throughout the main Plant area. The Site is located in the Gulf Coastal Lowlands physiographic region within the Gulf and

Atlantic Coastal Plain physiographic province. The Gulf Coastal Lowlands generally contain numerous wetlands which are interspersed with pine-palmetto flatwoods.

5.2 Geology

The Site is located in the Gulf Coastal Lowlands Physiographic Province. The Gulf Coastal Lowlands are characterized by three sedimentary sequences: (1) unconsolidated fine sand with interbeds of clay and marl; (2) fossilferous limestone and dolomite; and (3) gypsiferous limestone and dolomite. The primary sedimentary units underlying Pinellas County comprise a thick, continuous sequence of shallow-water platform carbonate rocks ranging in thickness from 10,000 to 12,000 feet.

The carbonate rocks underlying Pinellas County form a peninsula which separates Tampa Bay from the Gulf of Mexico. These rocks lie on the southwest flank of the Peninsula Arch. The Peninsular Arch is the dominant subsurface structure in southwest Florida whose axis trends in a northwest direction. In northern Pinellas County, these highly fractured units demonstrate a preferred fracture orientation of N 54° W to N 35° W.

Two distinct stratigraphic units exposed in Pinellas County: A thin veneer of fine sand with clay, marl, and phosphorite interbeds (surficial sand) and a thicker, highly variable calcareous sand to sandy clay with black phosphate nodules and chert (Hawthorn Formation). The Pleistocene surficial sand is located throughout the county except for in the south-central region. These deposits range in thickness from 5 to 50 feet and rest unconformably upon the underlying Tampa formation. The late Miocene Hawthorn formation is exposed in the south-central region and attains thicknesses of approximately 50 to 90 feet.

A thick sequence of carbonate strata unconformably underlies the surficial sediment. These strata are listed in descending order from youngest to oldest: the early Miocene Tampa formation - a poorly to semi-cemented, sandy limestone which thickens from 100 feet in the north to 250 feet in the south, the Suwanee formation; a white, fossiliferous, sandy limestone attains a maximum thickness of approximately 180 feet, and a series of Eocene limestones and dolomites which may achieve thicknesses of 3,000 feet including the Ocala formation - a fossiliferous, chalky limestone unit exhibiting some dolomitization; Avon Park formation - a limestone and dolomite unit containing intergranular evaporates; and the Lake City and Oldsmar formations - a chalky limestone with intergranular gypsum and anhydrite deposits.

5.3 Hydrogeology

Pinellas County is underlain by two primary aquifers, the surficial aquifer, and the Floridan aquifer. The surficial aquifer is a thin veneer of predominantly fine sand whose pore waters are influenced by atmospheric pressures. The water table rises and falls within the surficial aquifer in response to infiltration via precipitation, tidal changes, and variations in atmospheric pressures.

In eastern Pinellas, the depth to groundwater is relatively shallow and the saturated thicknesses range from 5 to 35 feet while averaging 15 feet. The thin nature of the surficial aquifer limits its usefulness as a drinking water supply; however, the aquifer adequately provides water for irrigation purposes. Hydrogeologists have measured mean horizontal conductivity (Kh), vertical conductivity (Kv), and storativity (S) values of 23 ft/day, 9 ft/day, and 0.3, respectively, for the surficial aquifer.

Underlying the surficial aquifer is a semi-confining, relatively continuous bed of clay to sandy clay. The clay unit behaves as a semi-confining unit separating the surficial aquifer from the Floridan Aquifer. Laboratory measurements indicate the vertical hydraulic conductivity of the clay ranges from 2.9×10^{-4} to 5.6×10^{-3} ft/day (1.0×10^{-7} to 2×10^{-6} cm/sec) with an average of 2.3×10^{-3} ft/day (8.1×10^{-7} cm/sec). In south-central Pinellas, the calcareous sand and sandy clay of the Hawthorn formation overlie the Floridan aquifer creating semi-confined to confined aquifer conditions.

The Floridan aquifer consists of a thick sequence of carbonate rocks which are hydraulically connected. The aquifer system is heterogeneous and groundwater flow is principally through a series of interconnected fractures and solution channels. A considerable amount of water is stored, and to a lesser degree transmitted, through the pore matrix of limestone units. Groundwater flow in the upper Floridan aquifer typically occurs under leaky-confined to confined conditions. In Pinellas County, the Floridan aquifer system encompasses the limestone units of the Tampa, Suwannee, Ocala, and Avon Park formations.

Locally, the top of the aquifer system is defined as the first competent sequence of limestone containing small percentages of clay, marl, and sand. This lithologic distinction coincides with the highly porous Tampa limestone. Conversely, the base of the aquifer is generally considered to occur at the first limestone or dolomite unit containing thin, continuous beds of gypsum. Locally, the base of the aquifer occurs at the formational contact separating the Avon Park and Lake City limestones.

Groundwater flow through the Floridan aquifer is by the way of a series of permeable units which typically do not coincide with formational boundaries. These permeable units consist of interconnected fractures and solution channels which are partly separated by dense carbonate beds containing clay seams of lower permeability. These less permeable units behave as semiconfining beds. Hydrogeologists have subdivided the Floridan aquifer into four hydrostratigraphic units separated by three semiconfining units. The shallowest of these hydrostratigraphic units are located approximately 10 to 140 feet below MSL (Tampa limestone) and approximately 250 to 330 feet below MSL (Suwannee limestone). Most production wells providing public water supply for Pinellas County are open exclusively to the upper hydrostratigraphic units. Aquifer tests performed on this unit yielded an average hydraulic conductivity value of 145 ft/day (5.1×10^{-2} cm/sec) and a storativity value of 7.7×10^{-4}. The deeper hydrostratigraphic units are predominantly saline within the study area and, thus, not considered important water sources.

The average annual water budget for Pinellas County consists of 53 inches of precipitation of which 39 inches (74%) is attributed to Evapotranspiration, 6 inches (11%) is attributed to surface water runoff, 6 inches as (11%) is attributed to groundwater recharge and 2 inches (4%) is attributed to leakage to the Floridan Aquifer. Predicted groundwater recharge rates in Pinellas County vary from 6 to 11 in/yr.

5.4 Surface Water and Drainage

Florida has created several water management districts. The individual districts have the regulatory responsibility for the management, retrieval and storage of any surface water and groundwater within the established boundaries. Pinellas County is located within the Southwestern Florida Water Management District (SWFWMD).

The most significant surface water features near the Tarpon Springs Site are the Anclote River, a recreational, Fish and Wildlife Class III-marine surface water body, located on the southern Site boundary and the Gulf of Mexico, located approximately two miles west of the Site. Class III-marine surface waters are defined as suitable for fishing and swimming. The Anclote River extends from south-central Pasco County, south into Pinellas County and then westward to the Gulf of Mexico. The Pinellas County Aquatic Preserve is approximately one mile downstream of the Site along this river. Upstream from the Site are the Port of Tarpon sewage treatment Plant, and the City of Tarpon Springs. Tidal movement can reverse river flow. The primary uses of this river include recreation and maintenance and propagation of wildlife. Stormwater runoff from the Site drains directly into the Anclote River.

5.5 Soil

According to the soil survey of Pinellas County, Florida (USDA-SCS, 1972), the primary soil underlying the Tarpon Springs area are of the Ashtabula St. Lucie Association. The deep sandy soil are relatively flat-lying and classified as extremely well drained. There are lesser percentages of Astar association consisting of poorly drained sandy soil overlain by organic-rich material, and the Ashtabbula-Adamsville Association, consisting of gently sloping, deep sandy soil. The study area is underlain predominately by Made Land soil (Ma) which consist of mixed sand, clay, hard rock, shells and shell fragments. The thickness of the Made Land soil typically ranges from 2 to 8 feet below ground surface. Adjacent to the Made Land Series to the north and east of the Site lie the Ashtabula (AfB) soil consisting of excessively drained, fine sands. Ashtabula soil (AfB) series predominantly underlies the Made Land soil throughout the Site.

5.6 Summary of Site Contaminants

5.6.1 Substances Detected in Soil

Soil sampl.s were collected at many different times during the Site investigation process. Initially, soil samples were collected by NUS (a company under contract with EPA to conduct the Site Inspection) for purposes of ranking the Site and placing it on the National Priorities List.. For the Expanded Site Investigation Report in 1989, four surface soil samples and twenty-two subsurface soil samples were collected and analyzed. Concurrent with sampling conducted by EPA, SMC utilized the services of Roy F. Weston to sample surface soil. Also in 1990, Weston collected 47 discrete samples of the surface soil and 47 samples of the subsurface soil. In addition to Weston's discrete soil samples, eight composite surface soil samples were collected in the northeast part of the Site. In 1990 Weston also collected an additional 35 subsurface samples. All of this information was compiled into the Past Work Document which has become Volume II of the Final Remedial Investigation Report. Pond material was analyzed to determine the maximum degree of contamination. Seventeen samples were collected by Weston in the pond areas on-Site.

The purpose of the Final Remedial Investigation Report (RI) was to confirm the past work and to further define the extent of contamination at the Site. As part of the RI, twenty-one surface and seven subsurface soil samples were collected to confirm the past work performed on-Site. The analytical results were consistent with the results from earlier sampling work.

Subsurface Soil

All subsurface soil samples (collected in 1993) were analyzed for Target Analyte List (TAL) metals, cyanide, fluoride, and total phosphorus. In addition to these parameters, two samples were analyzed for Target Compound List (TCL) volatiles, semi-volatiles, pesticides, and PCBs Radiological parameters were also tested.

Few TCL contaminants were detected in the subsurface soil sample locations. The only two TCL volatiles detected were acetone and methylene chloride. The only TCL semi-volatile was di-n-butyl phthalate. No TCL pesticides or PCBs were detected.

Arsenic, lead, fluoride, and total phosphorus were detected in the subsurface soil.

The radiological parameters of Gross Alpha, Gross Beta, Radium-226, Radon-222, and Polonium-210 were all detected in on-Site subsurface soil.

For more detailed information concerning the subsurface soil results please refer to the Final Remedial Investigation.

Surface Soil

As part of the RI, twenty-two discrete samples were collected in the main production area, northeast property, and southern property areas. In 1993, three discrete samples were collected at the Gulfside Elementary School located directly across the street from the Site on Anclote Boulevard. Ten additional surface soil samples were collected at the elementary school in February 1996. See Table 5-1 for further detail.

All samples on the elementary school property were detected at normal levels.

Surface soil samples were tested for one or more of the following: TAL metals, Cyanide, Fluoride. Total Phosphorus, Elemental Phosphorus. TCL volatiles. semivolatiles. pesticides. Gross Alpha Radiation, Gross Beta Radiation, and Gross Gamma Radiation. Specifically for the radiological parameters, an isotopic analysis was performed which confirmed that the radiological contamination is detected in the form of Radium 226.

Soil within the Site is contaminated with radionuclides primarily found in the uranium decay chain, specifically Radium 226. As noted earlier, radioactive waste material, suspected to have originated from the Phosphate ore (radium) processing Plant, were disposed on-Site. The radioactive decay of Radium 226 in soil causes elevated concentrations of radon gas and radon decay products.

In broad terms, the results of the assessment for surface soil were as follows:

- The main contaminants of concern for soil were radiological constituents, mostly located in the former slag processing area, railroads, road, and parking lots. In addition, some chemical contaminants including arsenic, antimony, beryllium, cadmium, chromium, thallium, PAHs, and fluoride, were identified. For a complete list of Potential Contaminants of Concern refer to Table 6-1.

- The pond material were not evaluated from a risk standpoint in the Final Baseline Risk Assessment (BVWST, 1994). The risk assessment assumed that this material would be treated or remediated. Radiological levels detected in the ponds exceeded residential and commercial use standards. Refer to Table 6-1 Potential Contaminants of Concern for a complete list of contaminants.

Contaminant detection tables for all media are presented as Table 5-1, 5-2, 5-3, and 5-4. These tables present the sampling results from the Remedial Investigation for the media of soil and pond material.

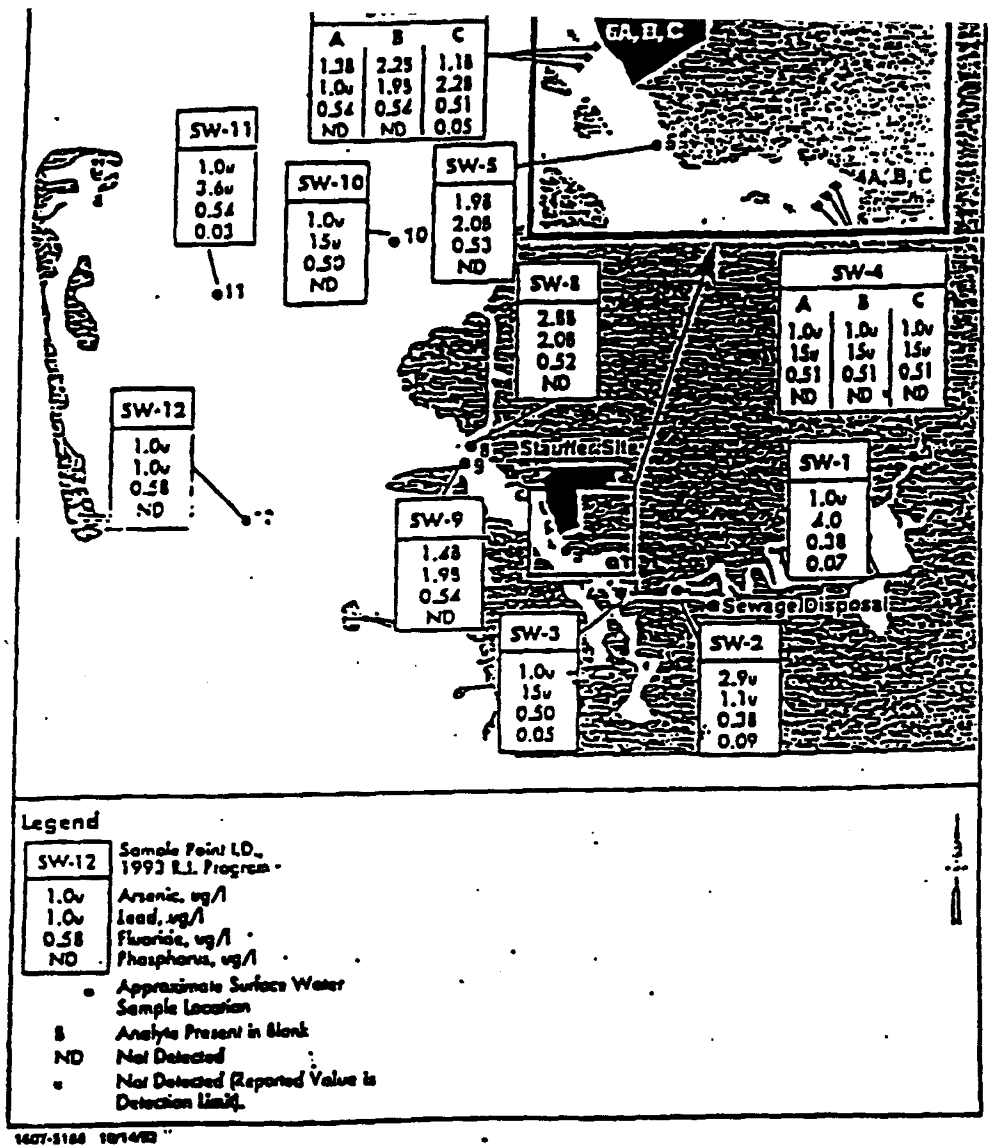
5.6.2 Substances Detected in Surface Water and Sediment

Surface water and sediment samples were collected from the Anclote River directly adjacent to the Site (located directly south and south-west of the Site property boundary). Surface water and sediment samples were collected in a two phase sampling event. The first phase focused on the comprehensive sampling of the Anclote River's surface water and sediment. The sample locations were selected to include areas upstream, areas downstream, and areas adjacent to the Site. The second phase of sample collection included a focused investigation of the sediment in the Myers Cove area adjacent to the Site. During the RI, a total of 15 surface water and 27 sediment samples were collected. Refer to Table 5-1, 5-2, and 5-3.

The results of the RI sampling documented that Site-related contamination was not detected in surface water above background (normal) levels. Only mercury and cadmium were detected (once each) above the National Oceanic and Atmospheric Administration (NOAA) Effect Range-Low (ER-L) guideline values, at sediment locations in Meyers Cove. Both contaminants did not exceed the NOAA Effects Range-Medium (ER-M) guideline values. For further detail, refer to the Final Remedial Investigation Report (WESTON 1993).

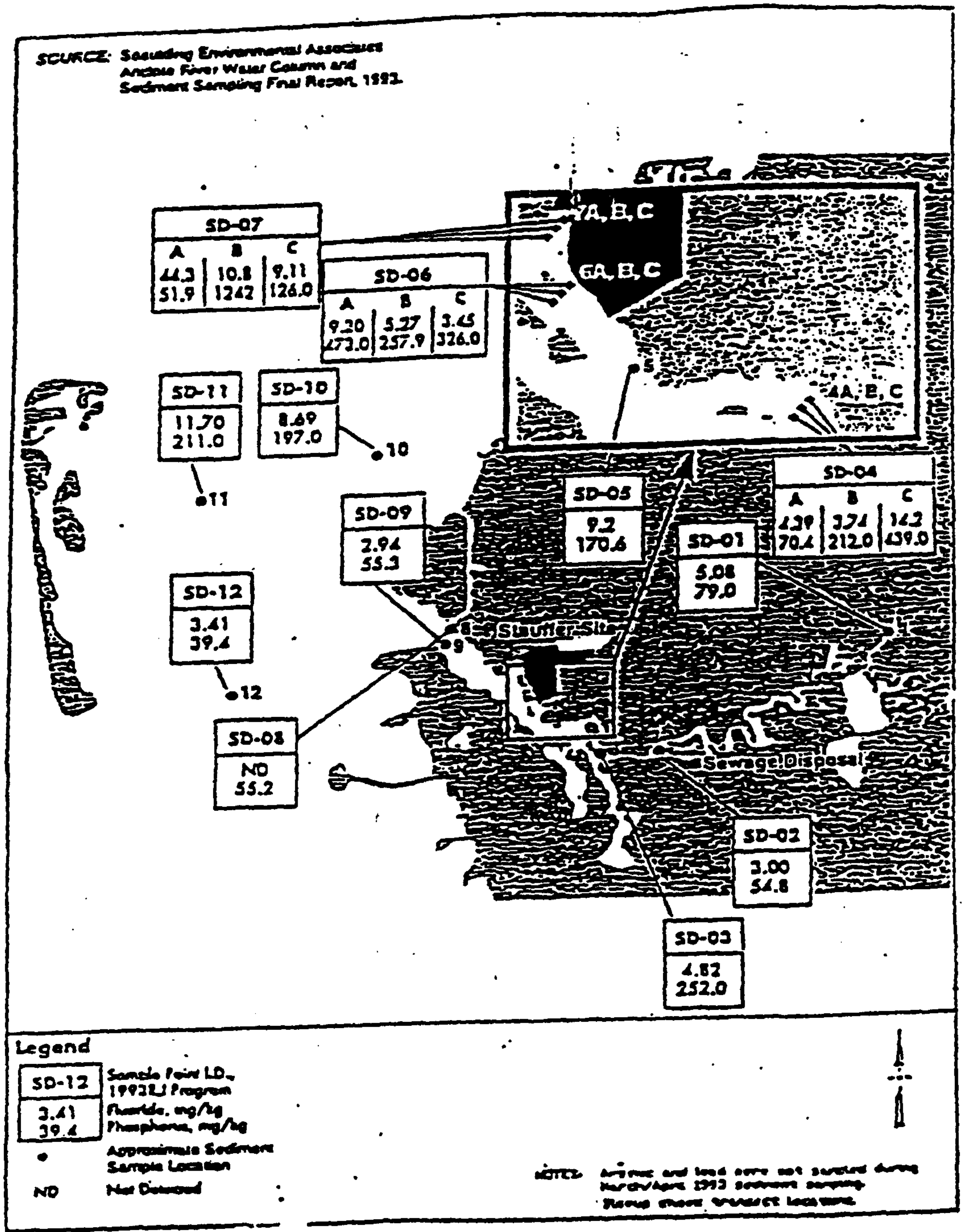
5.6.3 Air Monitoring

Air monitoring results obtained during the RI field work indicated that airborne volatile organics compounds were not problematic at the Site unless construction activities are in progress. Prior to excavation, drilling, and sampling activities, on-Site workers tested the air quality with either a flame ionizination detector (FID) and/or an organic vapor analyzer (OVA). Instrument readings were taken continuously at each drilling location for monitor wells. In addition VOCs were not detected during air monitoring conducted to support the health and safety plan. Elemental Phosphorus is the only contaminant of concern that may present a problem since it may ignite spontaneously when exposed to the atmosphere. Supported by historical information and the results of the RI field work, EPA has drawn the conclusion that airborne contaminant transport is not a significant migration pathway at the Site. The exceptions to this statement would exist when the pond and other contaminated areas are excavated or disturbed. This scenario may cause the Elemental Phosphorus to be exposed to the atmosphere. During the Removal Action construction activities on-Site, asbestos was detected at levels below the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit. Even though the asbestos levels are below the Permissible Exposure Limits, EPA will add asbestos to the list of Contaminants of Concern. This decision is based on input and concerns expressed by the community. Additional samples will be collected and analyzed for asbestos as part of the Remedial Design.



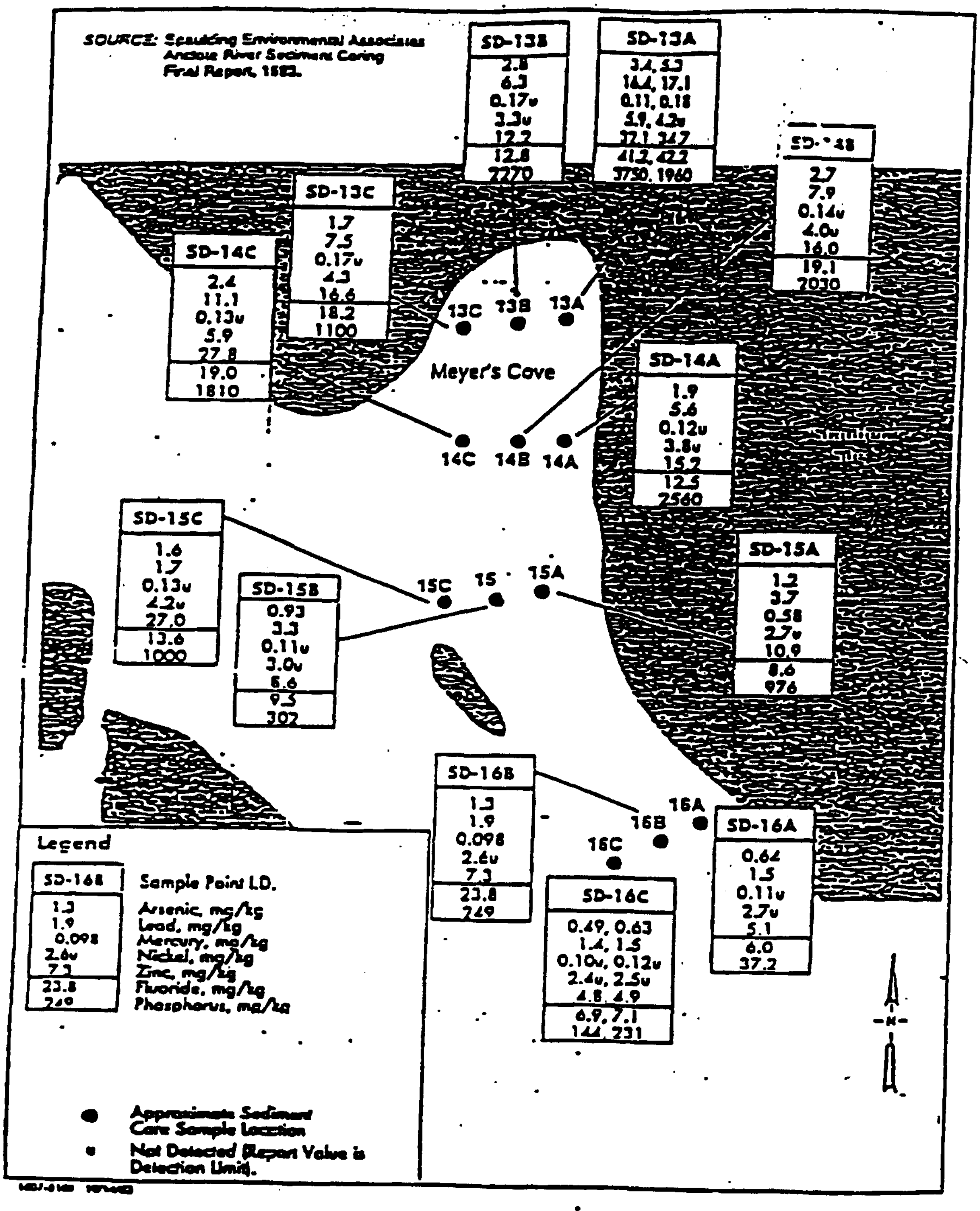
MARCH/APRIL 1993 SURFACE WATER ANALYTICAL RESULTS OF SELECTED PARAMETERS

Figure 5-1



MARCH/APRIL 1993 SEDIMENT ANALYTICAL
RESULTS OF SELECTED PARAMETERS

Figure 5-2



JULY 1993 SEDIMENT CORE ANALYTICAL
RESULTS OF SELECTED PARAMETERS

Figure 5-3

SURFACE SOIL SAMPLES

CHEMICAL	FREQUENCY OF DETECTS	RANGE OF DETECTS µG/KG	MEAN DETECTED CONCENTRATION µG/KG	MEAN BACKGROUND CONCENTRATION µG/KG	REGION III RESIDENTIAL SOIL** µG/KG
ORGANICS					
2-CHLOROPHENOL	1 / 9	50	50	ND	39,000
2-METHYLNAPHTHALENE	2 / 9	45 - 60	53	ND	
2,4-DINITROTOLUENE	1 / 9	780	780	ND	940
2,4,6-TRICHLOROPHENOL	1 / 9	990	990	ND	58,000
4-METHYLPHENOL	1 / 9	1300	1,300	ND	39,000
ACENAPHTHENE	1 / 9	220	220	ND	470,000
ACENAPHTHYLENE	2 / 9	110 - 770	440	ND	
ACETONE	3 / 8	23 - 1,800	620	ND	780,000
ALPHA-CHLORDANE	1 / 12	1.5	2	ND	490
BENZO[A]ANTHRACENE***	5 / 9	63 - 1,600	552	ND	
BENZO[A]PYRENE***	5 / 9	77 - 2,000	641	ND	88
BENZO[B]FLUORANTHENE***	6 / 9	68 - 4,300	1,203	ND	
BENZO[G,H,I]PERYLENE	6 / 9	45 - 1,600	389	ND	
BENZO[K]FLUORANTHENE***	5 / 9	42 - 1,100	360	ND	
CARBAZOLE	2 / 9	84 - 200	142	ND	32,000
CHRYSENE***	6 / 9	53 - 2,100	596	ND	
DI-N-BUTYL PHTHALATE	9 / 9	78 - 1,300	281	ND	780,000
DIBENZOFURAN	1 / 9	38	38	ND	
DIBENZ[A,H]ANTHRACENE***	2 / 9	100 - 340	220	ND	
FLUORANTHENE	6 / 9	64 - 1,600	458	ND	310,000
FLUORENE	2 / 9	75 - 450	263	ND	310,000
INDENO[1,2,3-CD]PYRENE***	5 / 9	88 - 1,600	470	ND	
ISOPHORONE	1 / 9	540	540	ND	670,000
METHYLENE CHLORIDE	4 / 8	7 - 25	15	ND	85,000
NAPTHALENE	1 / 9	48 - 48	48	ND	310,000
PENTACHLOROPHENOL	1 / 9	2,000	2,000	ND	5,300
PHENANTHRENE	5 / 9	40 - 340	167	ND	
PHENOL	1 / 9	840	840	ND	4,700,000
P,P-DDE	1 / 12	9	9	ND	1,900
P,P-DDT	1 / 12	4.4	4	ND	1,900
PYRENE	7 / 9	61 - 1,900	647	ND	230,000

*This table summarizes the chemicals that were detected in at least one sample in this medium. This initial list of chemicals is further evaluated by comparing to appropriate screening values, such as mean background concentrations, in order to select the list of chemicals of potential concern that will be evaluated in the BRA. In accordance with EPA Region IV guidance, the non-detects were not incorporated into the average concentrations. However, non-detects are included in the calculation of 95 percent Upper Confidence Limits.

** Region III values were obtained from the Risk Based Concentration Table, Fourth Quarter, 1993 (October 15, 1993).
For noncarcinogens, the target HQ was adjusted from 1.0 to 0.1 in accordance with EPA Region IV guidance.

*** The TEF approach will be used to evaluate risk from carcinogenic PAHs based on each compound's relative potency to the potency of benzo(a)pyrene.
Since the maximum concentration of benzo(a)pyrene exceeds its Region III screening value, all detected carcinogenic PAHs will be retained as COPCs in surface soil.

Sample SS93-2 was used as the background sample.

TABLE 5-1
SURFACE SOIL SAMPLES

CHEMICAL	FREQUENCY OF DETECTS	RANGE OF DETECTS µG/KG	MEAN DETECTED CONCENTRATION µG/KG	MEAN BACKGR CONCENTRAT µG/KG
INORGANICS				
ALUMINUM	18 / 21	287,000 - 6,810,000	2,765,050	631
ANTIMONY	9 / 21	4,900 - 32,300	14,689	ND
ARSENIC	13 / 21	410 - 127,000	26,885	ND
BARIUM	11 / 15	2,000 - 80,900	29,206	3.2
BERYLLIUM	13 / 21	160 - 1,600	672	ND
CADMIUM	11 / 21	590 - 57,400	14,346	ND
CALCIUM	18 / 21	36,000 - 377,000,000	109,968,167	2240
CHROMIUM	17 / 21	1,100 - 163,000	43,700	1.3
COBALT	10 / 21	1,100 - 33,300	7,360	ND
COPPER	14 / 21	1,800 - 65,500	20,386	0.92
FLUORIDE	19 / 21	2,400 - 2,810,000	401,774	ND
IRON	18 / 21	231,000 - 44,800,000	9,097,167	455
LEAD	17 / 21	1,600 - 324,000	58,694	7.5
MAGNESIUM	17 / 21	39,000 - 3,910,000	1,226,994	70.6
MANGANESE	18 / 21	590 - 292,000	88,099	20.6
MERCURY	2 / 21	230 - 420	325	ND
NICKEL	17 / 21	1,900 - 115,000	24,759	4
POTASSIUM	13 / 21	161,000 - 1,680,000	708,846	ND
SELENIUM	12 / 21	240 - 32,500	7,828	0.32
SILVER	4 / 21	1,200 - 9,700	4,225	ND
SODIUM	17 / 21	8,400 - 15,500,000	2,869,006	35.2
THALLIUM	8 / 21	370 - 13,400	4,110	ND
ZINC	18 / 21	770 - 519,000	120,943	3.8

*This table summarizes the chemicals that were detected in at least one sample in this medium. This initial list of chemicals is further evaluated by comparis screening values, such as mean background concentrations, in order to select the list of chemicals of potential concern that will be evaluated in the BRA. In a EPA Region IV guidance, *the non-detects were not incorporated into the average concentrations. However, non-detects are included in the calculation of 95 p* Upper Confidence Limits.

** Region III values were obtained from the Risk Based Concentration Table, Fourth Quater, 1993 (October 15, 1993).
For noncarcinogens, the target HQ was adjusted from 1.0 to 0.1 in accordance with EPA Region IV guidance.

*** The TEF approach will be used to evaluate risk from carcinogenic PAHs based on each compound's relative potency to the potency of benzo(a)pyrene. Since the maximum concentration of benzo(a)pyrene exceeds its Region III screening value, all detected carcinogenic PAHs will be retained as COPCs in surface soil.

Sample SS93-2 was used as the background sample.

TABLE 5-2
SEDIMENT SAMPLES

CHEMICAL	FREQUENCY OF DETECTION	RANGE OF DETECTS µG/KG	MEAN DETECTED CONCENTRATION µG/KG	MEAN BACKGRO CONCENTRATI µG/KG
INORGANICS				
ALUMINUM	12 / 27	358,000 - 4,280,000	1,954,750	ND
ARSENIC	12 / 27	490 - 3,400	1,763	ND
BARIUM	12 / 27	960 - 6,500	3,310	ND
BERYLLIUM	3 / 27	260 - 290	277	ND
CADMIUM	2 / 27	950 - 1,400	1,175	ND
CALCIUM	12 / 27	1,650,000 - 29,000,000	11,295,833	ND
CHROMIUM	12 / 27	1,700 - 15,400	7,325	ND
COPPER	12 / 27	3,200 - 20,900	9,025	ND
FLUORIDE	26 / 27	3,100 - 44,300	12,872	5
IRON	12 / 27	370,000 - 4,340,000	2,105,667	ND
LEAD	12 / 27	1,400 - 16,400	6,025	ND
MAGNESIUM	12 / 27	357,000 - 2,310,000	1,280,167	ND
MANGANESE	12 / 27	1,400 - 19,400	8,150	ND
MERCURY	3 / 27	98 - 580	286	ND
NICKEL	2 / 27	5,900 - 5,900	5,900	ND
PHOSPHORUS	27 / 27	37,200 - 2,560,000	639,993	117
POTASSIUM	11 / 27	204,000 - 828,000	493,364	ND
SELENIUM	2 / 27	260 - 420	340	ND
SODIUM	12 / 27	1,740,000 - 9,780,000	5,300,000	ND
ZINC	12 / 27	4,800 - 32,100	15,300	ND
ORGANICS				
ACETONE	1 / 2	15	15	ND
BIS(2-ETHYLHEXYL)PHTHALATE	1 / 2	260	260	44
METHYLENE CHLORIDE	1 / 2	4	4	2
PENTACHLOROPHENOL	1 / 2	100	100	ND
PHENOL	2 / 2	66 - 68	67	ND
PYRENE	1 / 2	68,000	68,000	ND
TOLUENE	2 / 2	51 - 62	57	32

*This table summarizes the chemicals that were detected in at least one sample in this medium. This initial list of chemicals is further evaluated by comparing to screening values, such as mean background concentrations, in order to select the list of chemicals of potential concern that will be evaluated in the BRA. In acco EPA Region IV guidance, the non-detects were not incorporated into the average concentrations. However, non-detects are included in the calculation of 95 perce Upper Confidence Limits.

** Region III values were obtained from the Risk Based Concentration Table, Fourth Quarter, 1993 (October 15, 1993).

For noncarcinogens, the target HQ was adjusted from 1.0 to 0.1 in accordance with EPA Region IV guidance.

Samples SD-1, SD-2, and SD-3 were used as background samples.

SURFACE WATER SAMPLES

CHEMICAL	FREQUENCY OF DETECTION	RANGE OF DETECTS µG/L	MEAN DETECTED CONCENTRATION µG/L	MEAN BACKGROUND CONCENTRATION µG/L	AWQC ** (Consumption of Organisms) µG/L
INORGANIC					
ALUMINUM	15 / 15	23 - 89	53	98	
ARSENIC	8 / 15	1 - 6	2	2	0.14
BARIUM	15 / 15	6 - 11	8	8	
CALCIUM	15 / 15	206,000 - 318,000	235,933	124,800	
COPPER	13 / 15	3 - 15	9	13	
FLUORIDE	15 / 15	0.49 - 1	0.52	0.42	
IRON	15 / 15	17 - 135	63	168	
LEAD	6 / 15	1 - 3	2	3	
MAGNESIUM	15 / 15	722,000 - 1,300,000	924,600	330,667	
MERCURY	11 / 15	0.13 - 1	0.29	0.27	0.15
PHOSPHORUS	4 / 15	0.05 - 0.06	0.06	0.09	
POTASSIUM	15 / 15	314,000 - 588,000	379,533	152,067	
SELENIUM	1 / 15	7	7	23	
SODIUM	15 / 15	6,380,000 - 10,900,000	8,001,333	4,260,000	
THALLIUM	1 / 15	17	17	19	6
ORGANIC					
ACETONE	1 / 2	24	24	15	
TOLUENE	1 / 2	9	9	48	200,000

*This table summarizes the chemicals that were detected in at least one sample in this medium. This initial list of chemicals is further evaluated by comparing to appropriate screening values, such as mean background concentrations, in order to select the list of chemicals of potential concern that will be evaluated in the BRA. In accordance with EPA Region IV guidance, the non-detects were not incorporated into the average concentrations. However, non-detects are included in the calculation of 95 percent Upper Confidence Limits.

** These values were obtained from the National Ambient Water Quality Criteria (updated December, 1992). The values listed represent human health, consumption of organisms parameters.

Samples SW-1, SW-2, and SW-3 were used as background samples.

TABLE 5 4
POND MATERIAL SAMPLES

CHEMICAL	FREQUENCY OF DETECTION	RANGE OF DETECTS µG/KG	MEAN DETECTED CONCENTRATION µG/KG	REGION III RESIDENTIAL SOIL** µG/KG
INORGANICS				
ALUMINUM	3 / 3	4,510,000 - 6,060,000	5,130,000	23,000,000
ANTIMONY	3 / 3	27,900 - 52,000	43,467	3,100
ARSENIC	3 / 3	19,800 - 205,000	83,500	360
BARIUM	3 / 3	46,100 - 114,000	74,133	550,000
BERYLLIUM	3 / 3	710 - 2,000	1,237	150
CADMIUM	3 / 3	15,300 - 36,300	28,800	3,900
CALCIUM	3 / 3	167,000,000 - 370,000,000	274,666,667	
CHROMIUM	3 / 3	30,000 - 226,000	104,800	39,000
COBALT	3 / 3	1,300 - 4,200	2,833	
COPPER	3 / 3	9,900 - 1,040,000	376,867	290,000
FLUORIDE	3 / 3	195,000 - 2,230,000	1,418,333	470,000
IRON	3 / 3	4,290,000 - 9,760,000	7,116,667	
LEAD	3 / 3	126,000 - 900,000	386,000	
MAGNESIUM	3 / 3	1,030,000 - 5,030,000	2,650,000	
MANGANESE	3 / 3	58,400 - 115,000	80,400	39,000
MERCURY	3 / 3	150 - 2,200	887	2,300
NICKEL	3 / 3	9,300 - 26,900	17,000	160,000
ELEMENTAL PHOSPHORUS	3 / 3	28,100,000 - 69,800,000	42,400,000	
POTASSIUM	3 / 3	933,000 - 4,820,000	2,354,333	
SELENIUM	3 / 3	6,600 - 35,100	23,433	39,000
SILVER	2 / 3	4,500 - 19,300	11,900	39,000
SODIUM	3 / 3	2,170,000 - 14,100,000	6,463,333	
THALLIUM	3 / 3	6,900 - 36,200	23,933	
ZINC	3 / 3	297,000 - 758,000	541,333	2,300,000

TABLE 5 4
POND MATERIAL SAMPLES

CHEMICAL ORGANICS	FREQUENCY	RANGE	MEAN DETECTED	REGION III
ACETONE	1 / 3	310	310	780,000
BENZO(A)ANTHRACENE***	1 / 3	2,800	2,800	88
BENZO(B)FLUORANTHENE***	2 / 3	160 - 5,200	2,680	88
BENZO(G,H,I)PERYLENE	2 / 3	93 - 1,500	797	
BENZO(K)FLUORANTHENE***	2 / 3	52 - 1,100	576	88
BIS(2-EHTYLHEXYL)PHTHALATE	1 / 3	2,200	2,200	46,000
CHRYSENE***	2 / 3	61 - 4,800	2,431	88
DI-N-BUTYL PHTHALATE	3 / 3	110 - 670	300	780,000
FLUORANTHENE	1 / 3	3,900	3,900	310,000
INDENO(1,2,3-CD)PYRENE***	2 / 3	120 - 1,800	960	88
METHYLENE CHLORIDE	2 / 3	5 - 27	16	85,000
PHENANTHRENE	1 / 3	2,000	2,000	
PYRENE	1 / 3	3,300	3,300	230,000

*This table summarizes the chemicals that were detected in at least one sample in this medium. This initial list of chemicals is further evaluated by comparing to appropria screening values, such as mean background concentrations, in order to select the list of chemicals of potential concern that will be evaluated in the BRA. In accordance wit EPA Region IV guidance, the non-detects were not incorporated into the average concentrations. However, non-detects are included in the calculation of 95 percent Upper Confidence Limits.

** Region III values were obtained from the Risk Based Concentration Table, Fourth Quarter 1993 (October 15, 1993). For noncarcinogens, the target HQ was adjusted from 1.0 to 0.1 in accordance with EPA Region IV guidance.

*** The TEF approach will be used to evaluate risk from carcinogenic PAHs based on each compound's relative potency to the potency of benzo(a)pyrene. The Region III screening value for benzo(a)pyrene is 88 ug/kg. All detected carcinogenic PAHs will be retained as COPCs in the pond material.

6.0 SUMMARY OF SITE RISKS

CERCLA directs EPA to conduct a baseline risk assessment to determine whether a Superfund Site poses a current or potential threat to human health and the environment in the absence of any remedial action. The baseline risk assessment provides the basis for determining whether or not remedial action is necessary. This risk assessment also provides the justification for performing the remedial action. Based upon this analysis, it was determined that the Site does pose a current or potential risk.

Site risks are summarized in the Revised Final Baseline Risk Assessment - Part A and B (BVWST-July 21, 1995), which was submitted as part of the Remedial Investigation, consist of three major sections: Risk Assessment - Chemical, Risk Assessment - Radiological, and the Baseline Ecological Risk Assessment. Chemical risks and radiological risks are discussed separately due to the complex nature of contamination at this Site. Following the discussion of each risk category, the risks posed by the aggregate categories will be summarized.

The major risks currently associated with the Site are inhalation, ingestion, and dermal contact with contaminated soil and slag. Actual or threatened releases of hazardous substances from the Site, if not addressed may present an imminent and substantial endangerment to human health, welfare, or the environment.

6.1 Risk Assessment Overview - Chemical

The chemical health threat at the Site is from heavy metal contamination. The major chemicals of concern are arsenic which is a known carcinogen and elemental phosphorus which is reactive when exposed to the air. See Table 6-1 for the list of Contaminants of Concern for the Stauffer Chemical/Tarpon Springs Site. Based on additional sampling results, and comments on the proposed plan asbestos and arsenic have been added to the list.

EPA Region 4 does not consider direct exposure to subsurface soil to be a standard scenario that should be evaluated in the baseline risk assessment for protection of human health and the environment. Therefore, chemicals of potential concern were not selected for subsurface soil; however, this medium will be evaluated for the protection of groundwater.

Table 6-1 Summary of Potential Contaminants of Concern

CHEMICAL	SOIL	SURFACE WATER	SEDIMENT	POND MATERIAL
Aluminum				
Antimony	X			X
Arsenic	X	X	X	X
Barium		X		
Beryllium	X		X	X
Cadmium	X			X
Chromium	X			X
Cobalt	X			X
Copper				X
Fluoride	X			X
Lead	X		X	X
Manganese	X			X
Mercury	X	X		X
Nickel				
Elemental Phosphorus	X			X
Selenium				
Thallium	X			X
Zinc				
2-Methylnaphthalene	X			
Acenaphthylene	X			
Acetone		X		
Benzo(a)anthracene	X			X
Benzo(a)pyrene	X			
Benzo(b)fluoranthene	X			X
Benzo(g,h,i)perylene	X			X
Benzo(k)fluoranthene	X			X
Chrysene	X			X
Dibenzofuran	X			
Dibenz(a,h)anthracene	X			
Indeno(1,2,3-cd)pyrene	X			X
Phenanthrene	X			X

6.2 Human Health Risk

6.2.1 Chemical

The Baseline Risk Assessment characterized potential current and future risks to human health and the environment from exposure to chemicals found on-Site.

The conceptual Site model for the Stauffer Chemical Site incorporates information on the potential chemical sources, affected media, release mechanisms, routes of migration, and known or potential human receptors. The purpose of the conceptual Site model is to provide a framework with which to identify potential exposure pathways occurring at the Site. Information presented in the RI, local land and water uses, and potential receptors was used to identify potential exposure pathways at the Site.

An exposure pathway consists of four elements: 1) a source and mechanism of chemical release; 2) a retention or transport medium (or media in cases involving media transfer of chemicals); 3) a point of potential human contact with the contaminated medium; and 4) an exposure route (i.e., ingestion) at the contact point. When all of these elements are present, the pathway is considered complete. The assessment of pathways by which human receptors may be exposed to contaminants includes an examination of existing migration pathways (i.e., soil and air) and exposure routes (i.e., inhalation ingestion, and dermal absorption), as well as those that may be reasonably expected in the future.

After the sources of contaminants are identified, the next step in the development of the conceptual model is to determine mechanisms of release to environmental media. The primary release mechanisms are infiltration, runoff, and tidal action from the disposal ponds, and spills leaching from the former Plant operating equipment. The secondary source of chemicals is surface and subsurface soil. Secondary release mechanisms include infiltration and surface runoff.

Contaminated groundwater and surface soil are believed to be the major sources of potential exposure for human receptors, followed by surface water, sediment, and air. The following paragraphs describe the pathways by which human receptors can be exposed to contaminated media.

Surface soil samples were collected from the main production, northeast property, and southeast property areas of the Site. A current or future maintenance worker may be exposed to contaminants in surface soil. Another potential future use may involve developing the Site for residential use. Therefore, a future resident will be evaluated for exposure to on-Site surface soil. For more detail please refer to the Final Revised Baseline Risk Assessment.

Surface water and sediment samples were collected at several locations along the Anclote River. A current or future resident may occasionally be exposed to surface water and sediment. Nearby residents or future on-Site residents may be exposed to chemicals in surface water and sediment via two exposure routes - fishing and/or swimming (or wading) in the Anclote River.

6.2.2 Radiological Overview and Assumptions

Since phosphate ore contains naturally occurring radioactive material (NORM), the slag material has appreciable amounts of measurable radioactivity which has been technically enhanced. The phosphate ore production activity apparently concentrated the radiation in the slag and disposed of the slag in the processing area of the Site. The Baseline Risk Assessment identified the major potential risks associated with the NORM components of the slag material.

The identification of potential pathways for radiological risk analysis is similar to that used for chemical risk analysis. However, several major differences do exist and need to be considered. First, radionuclide intake through the skin is a minimal pathway and need not be analyzed (i.e., dermal contact will not be a considered pathway). Second, the presence of Ra-226 in the soil at the Site indicates that Rn-222 emanation will occur and provide a potential pathway. Third, the NORM radioactivity in the soil from the processing produces an ambient radiation field that exceeds background levels.

The following assumptions were made to assess the major pathways of exposure.

1. Consistent with the risk analysis performed for the chemical hazards on the Tarpon Springs Site, the potential receptors are designated as listed below:

    a. On-Site Worker (current and future)
    b. Off-Site Adult Resident (current)
    c. Off-Site Child Resident (current)
    d. On-Site Adult Resident (future)
    e. On-Site Child Resident (future)

2. Some monitoring results identify the presence of the nuclides K-40 and Cs-137 in relatively small concentrations. These nuclides were not considered as part of this analysis. Cs-137 is a fission product that is found worldwide in environmental samples. Processing at the Tarpon Springs Site should not have enhanced the concentration of this isotope to significant levels greater than those found elsewhere in Florida. K-40 is a naturally occurring radioisotope that is part of elemental potassium. Its presence in concentrations above normal (background) are of negligible radiological concern because the amount of potassium in the human body at any given time is under control (i.e., the body regulates how much K-40 is present in tissues at any time).

3. To the extent possible, parameters were used to be consistent with the chemical risk analysis. This includes water consumption rate, exposure fractions, exposure durations, and soil/sediment ingestion rates. Alternate parameters from recognized standards were used in specific pathways as needed and are described in the discussion of each model.

4. Because the radiological data from the various sources are in relative agreement with each other (i.e., the mean and average do not vary by orders of magnitude), the maximum reported concentration for an environmental sample will be utilized in all calculations. This approach provides a bounding value for the risk associated with the pathways.

5. Consistent with the discussion presented for the chemical risk analysis, fugitive dust is not considered to be a pathway for exposure.

6. Consistent with the discussion presented for the chemical risk analysis (B&V 1994), off-Site drinking water is solely from the local city water supply. Therefore, no current ingestion of groundwater is assumed to take place. However, an analysis is performed for future on-Site residents who may use wells on the Tarpon Springs Site for drinking water purposes.

7. Consistent with the discussion presented for chemical risk analysis, current off-Site child residents are assumed not to be exposed to sediment.

8. No isotopic data were present for surface water; therefore, scenarios using surface water were not analyzed.

9. For purposes of analysis of soil data, the activity of Ac-227 is assumed to be equal to that of Th-227, since these would most likely be in secular equilibrium. Similarly, the activity of Pb-210 is assumed to be equal to that of Ra-226, and the activity of Th-228 is assumed to be equal to that of Pb-212. These assumptions are necessary because published risk factors do not include long-lived progeny. Therefore, it is necessary to consider the activities of parent isotope and long-lived progeny separately with regard to activity and risk.

10. Risk values are taken from "Health Effects Assessment Summary Tables (FY1992)" (EPA 1992) except as noted for the scenario involving irradiation by roadbed material.

6.3 Summary of Exposure Scenarios

This section discusses the rationale for selection of exposure pathways and routes of concern for both the current and future exposure scenarios.

Table 6-2 and 6-3 represent the carcinogenic and non-carcinogenic risk posed by chemical contaminants of concern for significant pathways. Table 6-4 represent a comparison of the maximum detection concentration of lead and the EPA Interim Soil cleanup level for residential soil.

6.3.1 Summary of the Chemical Exposure Scenarios

Current/Future Maintenance Worker

On-Site maintenance workers were assumed to be exposed to Site-related contaminants in surface soil or fugitive dust emissions during landscaping, mowing, or other outdoor activities. The routes of exposure considered for the on-Site maintenance worker were incidental ingestion and dermal contact with contaminants in surface soil and inhalation of fugitive dust. It was assumed that if the Site remains commercial/industrial in the future, a maintenance worker would still have the greatest potential for exposure to Site contaminants. Therefore, the future worker scenario is the same as the current worker scenario.

The air pathway was qualitatively evaluated as an exposure pathway for particulate emissions from surface soil. With the exception of the slag processing area, the majority of the Site is either vegetated or covered by impervious material. Inorganic chemicals present in surface soil in the slag processing area may adsorb to soil particles which could then potentially be transported via wind erosion. Although surface soil in the slag processing area are relatively homogeneous, the surface is not elevated and the soil is compact.

The closest residential areas and Gulfside Elementary School are north of the Site. The grassy area just east of the slag processing area represents the most critical (closest) area of concern for a maintenance worker. Based on the location of these receptors (maintenance worker, pupils at school, and nearby residents), winds from the south and west would provide the most critical wind conditions. Also, in order for wind erosion to occur from limited reservoir surfaces, wind speeds of approximately 22 miles per hour would be required. Since the average annual wind speed in the Tarpon Springs area is only 10 to 15 miles per hour in the afternoon and 5 to 10 miles per hour at night, and the prevailing winds in the Tarpon Springs area are from the north and east, it is assumed that exposure via inhalation of fugitive dust does not present a significant exposure pathway. Therefore, the air pathway was not quantitatively evaluated as an exposure pathway for particulate emissions.

The maintenance worker was quantitatively evaluated for exposure to surface soil via incidental ingestion and dermal contact.

Current Off-Site Resident

The Anclote River is classified as a Fish and Wildlife Class III-marine surface water body. Class III-marine surface waters are defined as suitable for fishing and swimming. Stormwater runoff and groundwater discharge flow directly into the Anclote River; therefore, it is assumed that nearby residents may be exposed to Site-related contaminants during recreational and fishing activities.

Direct contact with surface water and sediment was evaluated for an adult resident (age 7 to 30). Potential exposure routes included incidental ingestion and dermal contact with surface water and sediment. It was assumed that children under the age of seven would be under parental supervision and any direct exposure to the river would be negligible. An additional pathway that was evaluated for the off-Site resident (child and adult) included ingestion of contaminated fish that are caught in the Anclote River.

Future Resident

Based on surrounding land use, it was assumed that residential development might occur on-Site in the future. Potential pathways through surface soil exposure included in incidental ingestion and dermal contact. Sediment and surface water exposure were identical to that discussed in the current use scenario. These pathways included incidental ingestion and dermal contact using the adult (age 7-30 years) as the likely exposure receptor, and ingestion of locally caught fish (age 1-30 years). Groundwater was evaluated due to the hypothetical possibility of future contamination of off-Site private drinking wells or the installation of a residential well on-Site. The potential exposure pathways involved the ingestion of drinking water.

6.3.2 Summary of Radiological Exposure Scenarios

The scenarios considered for potential intakes to radioactive material are summarized in Table 6-5 and 6-6, along with the radiological data used for the risk assessment.

Table 6-5 presents the analytical results of samples collected during the Remedial Investigation as it relates to the assumptions used in the risk assessment and potential receptor scenarios.

Table 6-6 presents the estimated individual radiological pathway and cumulative radiological pathways exposure risk scenarios. The potential receptors are listed in the first row. Exposure scenarios are presented in the first column.

Table 6-2
Contaminants of Concern that Pose a Carcinogenic Risk Greater Than 10^{-6} for Pathways That Exceed 10^{-4}

Exposure Medium/ Pathway	Current/Future Maintenance Worker	Current Off-Site Resident	Future On-Site Resident
Surface Soil	NONE	NE*	Benzo(a)anthracene.............. 2×10^{-6} Benzo(a)pyrene..................... 2×10^{-5} Benzo(b)fluoranthene........... 5×10^{-6} Dibenzo(a,b)anthracene........ 4×10^{-6} Indeno(1,2,3-cd)pyrene........ 2×10^{-6} Arsenic.................................. 3×10^{-4} Beryllium............................... 6×10^{-6}
Surface Water	NE*	NONE	NONE
Sediment	NE*	NONE	NONE

* Note that NE means that the pathway was not evaluated for this receptor.

Table 6-3
Contaminants of Concern with a Hazard Quotient Greater Than 0.1 for Pathways with a Hazard Index Exceeding 1.0

Exposure Medium/ Pathway	Current/Future Maintenance Worker	Current Off-Site Resident Adult	Future On-Site Resident Adult	F R
Surface Soil	Arsenic......4×10^{-1} Thallium.....1×10^{-1}	NE	Arsenic......6×10^{-1} Thallium....1×10^{-1}	Flu An Ar Ca Th
Surface Water	NE	Arsenic.....2×10^{-1} Mercury....4	Arsenic......2×10^{-1} Mercury.....4	Ars Mer
Sediment	NA	NA	NA	

Notes: * NE means that the pathway was not evaluated for this receptor.
** NA means that all hazard indices were less than 1.0 for sediment.

Table 6-4
Comparison of Maximum Detected Concentrations of Lead to ARARs

Surface Soil (mg/kg)	Residential Cleanup Leve (mg/kg)
324	500

Table 6-5 Scenarios Analyzed for the Radiological Risk Analysis

Scenario		Potential Receptor	Monitoring Data Used to Assess Risk
Incidental Ingestion of Soil		1. Current/Future Worker 2. Future On-Site Adult Resident 3. Future On-Site Child Resident	Surface Soil Ra-226: 73.8 pCi/g Pb-210: 73.8 pCi/g Ra-228: 29.3 pCi/g U-238: 29.1 pCi/g U-235: 0.7 pCi/g Ac-227: 0.8 pCi/g Th-228: 0.2 pCi/g
Ingestion of Vegetation Grown on Contaminated Soil		1. Future On-Site Adult Resident 2. Future On-Site Child Resident	Surface Soil (as above)
Direct Irradiation by Contaminated Soil		1. Current/Future Worker 2. Future On-Site Adult Resident 3. Future On-Site Child Resident	Surface Soil (as above)
Inhalation of Rn-222	Indoor Exposure	1. Current/Future Worker 2. Future On-Site Adult Resident 3. Future On-Site Child Resident	Rn-222 Flux: 8136 pCi/m²/hr
	Outdoor Exposure	1. Current Off-Site Adult Resident 2. Current Off-Site Child Resident	
Incidental Ingestion of Sediment		1. Current Off-Site Adult Resident	Sediment Ra-226: 2.4 pCi/g
Ingestion of Groundwater		1. Future On-Site Adult Resident 2. Future On-Site Child Resident	Groundwater Ra-226: 24.9 pCi/l
Irradiation by Roadbed Material		1. Current/Future Worker 2. Future On-Site Adult Resident 3. Future On-Site Child Resident	Radiation Survey Measurements of On-Site Roadway 150 µR/hr

Table 6-6 Estimated Radiological Risk Considering Major Pathways

Exposure Scenario	Lifetime Risk				
	Current/ Future Worker	Current Off-Site Adult Resident	Current Off-Site Child Resident	Future On-Site Adult Resident	Future On-Site Child Resident
Incidental Ingestion of Soil	4E-05			5E-05	3E-05
Ingestion of Vegetation Grown on Contaminated Soil				2E-02	6E-03
Irradiation by Contaminated Soil	3E-03			1E-02	3E-03
Inhalation of Rn-222 (Indoor Exposure)	1E-03			7E-03	2E-03
Inhalation of Rn-222 (Outdoor Exposure)		2E-05	4E-06		
Incidental Ingestion of Sediment		3E-08			
Ingestion of Groundwater				5E-05	6E-06
Irradiation by Roadbed Material	5E-03			4E-03	1E-03
TOTAL	9E-03	2E-05	4E-06	4E-02	1E-02

NOTE: Shaded boxes indicate that the given exposure scenario is not applicable for the indicated receptor.

6.4 Ecological Risks

The objective of ecological risk assessment was to use available toxicological and ecological information to estimate the probability that some undesired ecological event will occur. The baseline ecological risk assessment (BERA) evaluated the actual and potential risks to the environment due to releases of contaminants at the Site. The general objective of a BERA is to provide the information necessary to assist in the decision-making process at remedial Sites.

Media of concern for ecological receptors generally include surface water, sediments, surficial soil. and air. These are media that may have direct or indirect effects on the community and population composition of an ecological habitat or on individual species that are part of those communities or populations.

Ecological chemicals of concern may often include more individual chemicals than the human health assessment because the screening criteria for human health do not apply to ecological receptors. As a result, different screening criteria are used to limit the chemicals evaluated in the ecological assessment. The preliminary list of ecological chemicals of concern initially included all chemicals detected during previous environmental sampling events. No protected species were found at the Site This list was then evaluated as follows:

1) Chemicals were eliminated if they were not detected in RI/FS environmental samples.

2) Inorganic chemicals were eliminated if the detected concentrations did not exceed the sample quantitation limit or the background concentration (provided that the sample quantitation limit or the background concentration do not themselves exceed screening levels).

3) Organic chemicals were eliminated if the detected concentrations did not exceed the sample quantitation limit (provided that the sample quantitation limit itself does not exceed screening levels).

4) All chemicals were eliminated if they were only tentatively identified.

5) All chemicals with a low frequency of detection (less than 5 % for each medium) were eliminated from consideration.

6) All chemicals in groundwater for which the range of detection did not exceed the Region 4 Screening Values were eliminated from consideration.

7) Chemical concentrations in sediments that did not exceed the screening values established by Region 4 for hazardous waste Sites were eliminated.

The following is a list of contaminants which include all those exposure point concentrations which exceed screening concentrations.

Table 6-7 Ecological Summary of the Contaminants of Concern

Contaminants of Concern for Ecological Risk	
Aluminum	Acenaphthalene
Arsenic	Anthracene
Cadmium	Benzo(a)pyrene
Copper	Bis(2-ethylhexyl)phthalate
Iron	Chrysene
Mercury	Dibenz(a,h)anthracene
Nickel	Fluorene
Phosphorus	Fluoranthene
Silver	Phenanthrene
Thallium	Pyrene
	Zinc

The overall risk to the extended community on or immediately adjacent to the Stauffer Chemical Site is considered low to moderate. Causes for concern are that several contaminants currently exceed screening values in both sediment and surface water. In addition several contaminants were detected in shallow groundwater samples at relatively high concentrations and would be expected to contribute to the overall contaminant load in the adjacent wetland and deepwater habitats. Moderating the overall risk to the extended community is the dilution effect of the Anclote River and the tendency of the wetlands adjacent to the Site to partition some contaminants to deeper sediments, restricting their effect to a limited area. Based on information currently available to the EPA contractor, the BERA was developed primarily based on chemical contaminants since minimal information was found on the ecological impact of radiological contamination. All available information concerning the ecological impact of chemical and radiological contamination was considered in the decision making process. Further ecological or eco-toxicological investigation is not warranted at the Site.

6.5 Cleanup Levels

Cleanup levels for the Site were established to ensure that any person exposed in the future will not be exposed to unsafe levels of Site-related chemicals. Cleanup levels are either the Federal Maximum Contaminant Limits (MCLs), other Applicable or Relevant and Appropriate Requirements (ARARs), or risk-based concentrations. At the Site, EPA requires that soil be remediated up to a 10^{-6} residential risk level for cancer causing contaminants and a Hazard Index (HI) of 1 for non-carcinogenic chemicals. For the radiological contamination, a ARAR is used as the cleanup standard. These levels are consistent with the National Contingency Plan (NCP) and EPA requirements for cleanup levels of carcinogenic chemicals with in the 10^{-4} to 10^{-6} risk range and are protective of human health and the environment in a residential setting. This risk range of 10^{-4} to 10^{-6} means that exposure to Site-specific contaminants as defined as in the risk assessment would result in an estimated increase in an individual's chance of developing cancer ranging from one in ten thousand to one in a million. For non-cancer causing risks, EPA compares the highest dose known to be safe (not cause harmful effects) to the estimated dose from exposure to levels found on-Site. These comparisons were used to develop cleanup levels for Contaminants of Concern for the soil/waste at the Site. Elemental phosphorus is a CERCLA listed Hazardous Substance.

Arsenic, a Contaminant of Concern at this Site, is a naturally occurring mineral that is considered by EPA to be a systemic toxicant and a human carcinogen. However, there is considerable uncertainty concerning its ability to cause cancer at low exposure levels, especially the less soluble form that occurs in contaminated soil. The Superfund program of EPA Region 4 regulates arsenic in soil as a systemic toxicant in deriving protective cleanup levels. As an additional precaution, EPA also requires soil cleanup levels to fall within the protective cancer risk range of 10^{-4} to 10^{-6} for the most sensitive likely receptor even though the calculated risk may be significantly over predictive. The co-location of arsenic with other contaminants that are to be addressed in soil remediation will likely result in soil arsenic residuals at the more protective end of the calculated risk range.

Table 6-8
Cleanup Standards: Remedial Goals

Soil/Waste Contaminant	Maximum Concentration Detected (mg/kg)	Remedial Cleanup Goals (mg/kg)
Arsenic	127	#
Antimony	32.3	28.1
Beryllium	1.6	0.192
Elemental Phosphorus	0.854	1.4
Thallium	13.4	1.4
Radium-226 (Lead-210)*	73.8 pCi/g	5 pCi/g
Total CPAHs**	–	0.089

* Note that this cleanup level is measured above the background (normal) concentration. The background (normal) concentration will be established during the Remedial Design.

** Total CPAHs include Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenzo(a,h)anthracene, and Indeno(1,2,3-cd)pyrene.

\# EPA Region 4 regulates arsenic in soil as a systemic toxicant with a reference dose of 0.0003 mg/kg/day. The safe soil level for residential use that would not exceed this RfD for a child was determined in the Site's risk assessment to be 21.1 mg/kg. EPA also considers arsenic to be a carcinogen in the form that may occur in drinking water and has included an oral slope factor in its IRIS database. The application of the slope factor here, though not considered appropriate, would yield a calculated safe soil level for a child at the most protective 10^{-6} risk level of 0.46 mg/kg. The latter soil cleanup level for arsenic is likely to be achieved since soil containing arsenic above this level also contains other contaminants that will require remediation.

Table 7-1
Response Actions and Associated Remedial Technologies Screening

General Response Action	Associated Remedial Technologies Considered after the Screening Process
Elemental Phosphorus-Containing Material	
No Action	None
Institutional Controls	Access restrictions Land use restrictions Groundwater monitoring
Treatment	Conversion to phosphoric acid Incineration Aqueous oxidation Low temperature air oxidation Stabilization/Solidification
Site Soil	
No Action	None
Institutional Controls	Access restrictions Land use restrictions Groundwater monitoring Groundwater use restrictions
Excavation/Consolidation	Excavation and Consolidation of affected soil
Containment	Capping/Cover Liner
Treatment	Stabilization/Solidification Volume reduction

A summary of how the alternatives address affected media and the associated technologies utilized are presented in Table 7-2.

Alternative 1: No Action

The No Action Alternative is carried through detailed evaluation as a point of reference to the other alternatives. For this FS, it is assumed that groundwater monitoring would be continued, even if no further remedial action were initiated.

Alternative 2: Institutional Controls

Institutional controls provide some degree of control of future land use. As was the case under the west central portion of the Main Plant Area would require remediation at depth to meet the 5 pCi/g above background standard.

In addition to excavating and consolidating radiological contaminated material/soil and Ponds 39 and 42, soil exceeding a chemical carcinogenic risk level of 1×10^{-06} or a hazard index of 1.0 would also be excavated and placed in one of the consolidation areas. As noted in Alternative 3a, locations over which cover would be placed would not be excavated.

Alternative 4a: Consolidation and Capping (Commercial Use)

This alternative includes the same activities and institutional controls noted for Alternative 3a: excavation and consolidation of radiologically and chemically contaminated material/soil in several consolidation areas exceeding commercial use levels. However, under this alternative, the consolidated material in the main pond areas would be capped, rather than covered, to further decrease the potential migration of contaminants from the consolidated material into the surficial aquifer. A synthetic membrane and drainage system would be included as part of the cap.

In addition to reducing contaminant migration into the surficial aquifer, based on the Soil Cover Depth Study (WESTON, 1994a) findings, the cap would reduce gamma radiation exposure to someone working on the cap. Under the Consolidation and Capping Alternative, institutional controls would prevent the development of the capped area; therefore, reducing the gamma radiation exposure. Also, the synthetic membrane of the cap would reduce the escape of radon gas from the consolidation area.

As with the Institutional Controls Alternative, groundwater and surface water monitoring would be continued, and the fences which currently surround the entire property would be maintained. Notification of Site conditions would be included in the property deed to alert prospective buyers of Site conditions and deed restrictions would be implemented. These restrictions would prohibit

future development of the covered pond areas, and would restrict the remainder of the Site to commercial use. A final restriction would be that no surficial groundwater wells, for any purpose, could be installed on any portion of the property.

Alternative 4b: Consolidation and Capping (Residential Use)

This alternative includes the same activities and institutional controls noted for Alternative 3b: excavation and consolidation of radiologically and chemically contaminated material/soil found on Site exceeding residential use levels. However, under this alternative, the consolidated material at locations on-Site would be capped, rather than covered, to further decrease the potential migration of contaminants from the consolidated material into the surficial aquifer. The cap would be constructed in the same way as mentioned in Alternative 4a. Based on residential cleanup goals, radiologically contaminated material would be remediated if they exceed 5 pCi/g above background for soil, regardless of depths. The areas requiring remediation under the residential would generally be used for material presently located within the pond area; ex-situ stabilization would be performed on excavated material. A combination of material stabilization and placement of a soil cover will reduce contaminant migration and shield low-level radiation.

As with the Institutional Controls Alternative, groundwater and surface water monitoring would be continued, and the fences which currently surround the entire property would be maintained. Notification of Site conditions would be included in the property deed to alert prospective buyers of Site conditions and deed restrictions would be implemented. These restrictions would prohibit future development of the covered pond areas, and would restrict the remainder of the Site to commercial use. A final restriction would be that no surficial groundwater wells, for any purpose, could be installed on any portion of the property.

Alternative 7b: Consolidation, Stabilization, and Cover (Residential Use)

This alternative would provide the same treatment and capping identified for Alternative 7a. However, the extent of soil excavated/stabilized would be expanded to meet residential use criteria.

Based on residential cleanup goals, radiologically contaminated material would be remediated if they exceed 5 pCi/g above background for soil, regardless of depths. The areas requiring remediation under the residential land use scenario encompass those for the commercial use scenario plus all soil that has radiation levels between 5 and 15 pCi/g at depths greater than 15 cm. In addition to the areas described for commercial use, an additional area in the west central portion of the Main Plant Area would require remediation at depth to meet the 5 pCi/g above background standard.

8.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

8.1 Comparative Analysis - Nine Criteria

This section of the ROD provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA, 42 USC 9621, and in the NCP, 40 CFR 300.430. The major objective of the feasibility study (FS) was to develop, screen, and evaluate alternatives for the remediation of the Site. A wide variety of alternatives were identified as candidates to remediate the contamination at the Site. These were screened based on the contaminants present and Site characteristics. After the initial screening, the remaining alternatives/technologies were combined into potential remediation alternatives and evaluated in detail. The selected remedial alternative emerged from the screening process using the following nine evaluation criteria:

- Overall Protection of Human Health and the Environment
- Compliance with ARARs
- Short-Term Effectiveness

(ARARs). Applicable requirements are those standards, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA Site. Relevant and Appropriate Requirements are those that, while not applicable, still address problems or situations sufficiently similar to those encounter at the Site and that their use is well suited to the particular Site. To-Be-Considered Criteria (TBCs) are non-promulgated advisories and guidance that are not legally binding, but should be considered in determining the necessary level of cleanup for protection of human health or the environment. While the TBCs do not have the status of ARARs, EPA's approach is to determine if a remedial action is protective to human health and the environment involves consideration of TBCs along with ARARs.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely on the basis of location . Examples of location-specific ARARs include state and federal requirements to protect floodplains, critical habitats, and wetlands, and solid and hazardous waste facility siting criteria. Table 8-1 summaries the potential location specific ARARs and TBCs for the Site.

Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by particular remedial activities that are selected to accomplish a remedy. Since there are usually several alternative actions for any remedial Site, various requirements can be ARARs . Table 8-2 lists potential action-specific ARARs and TBCs for the Site.

Chemical-specific ARARs are specific numerical quantity restrictions on individually listed contaminants in specific media. Examples of chemically-specific ARARs include the MCLs specified under the Safe Drinking Water Act as well as the ambient water quality criteria that are enumerated under the Clean Water Act. Since there are usually numerous contaminants of potential concern for any remedial Site, various numerical quantity requirements can be ARARs. Table 8-3 lists potential chemical-specific ARARs.

Alternatives 4, 5, and 7 met or exceed all ARARs (action-, location-, and chemical-specific). Alternative 4 currently meets surface water ARARs, but this alternative may not provide a permanent solution for the surface water. Alternatives 1, 2, 3, and 4 would leave the contamination in a state where it is still available to move off-Site through the surficial aquifer.

Table 8-2
Action-Specific ARARs

Applicable (A) or Relevant & Appropriate (R & A)	Citation	Comments
A	Identification and Listing of Hazardous Waste 40 CFR Part261	Identifies those solid wastes which are subject to regulation as hazardous waste. Defines "hazardous waste" and "solid waste"
R & A	Generators of Hazardous Waste 40 CFR Part 262	Establishes Standards for generators of hazardous waste.
R & A	Transporters of Hazardous Waste	Establishes the responsibility of generators and transporters of hazardous waste.
A	Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TSD) Facilities 40 CFR 264	Establishes minimum national standards for which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose of hazardous waste.

8.3.5 Cost

A summary of the present worth costs which include capital as well as operations and maintenance costs for each alternative is presented in Table 8-5.These cost were presented in the FS. The present worth costs to attain the recommended performance standards (**Section 9.2**) and to meet the requirements of the compliance testing (**Section 9.3**) must remain within the range which is considered accurate (+50% or -30% of the present worth cost).
Alternative 2 is the least costly alternative, other than the No Action alternative. Of the treatment alternatives, Alternative 5 is less expensive than Alternative 7 and affords the same level of protection. The residential scenarios are only slight more expensive than the commercial use scenarios, but the residential scenarios are found to be the more protective than the commercial scenarios.

8.4 Modifying Criteria

8.4.1 State Acceptance

The State of Florida, as represented by the Florida Department of Environmental Protection (FDEP), has been the support agency during the Remedial Investigation/Feasibility Study (RI/FS) process for the Site. In accordance with 40 CFR 300.430, FDEP as the support agency, has provided input during the process by reviewing and providing comments to EPA on all major documents in the Administrative Record. Based upon comments received from FDEP, it is expected that written concurrence will be forthcoming; however , letter formally recommending concurrence with EPA's selected remedy has not been received.

8.4.2 Community Acceptance

Based on written comments received during the extended comment period, it appear that the public would prefer off-Site disposal; even though, it may be more expensive, more difficult to implement, and riskier (may exposure them to the contamination). Atkemix Thirty-seven Incorporated (the PRP) commented that they preferred the commercial use as opposed to the residential use scenario. Zeneca does recommend Alternative 5. Specific response issues raised by the community and other interested parties are summarized in Appendix A, the Responsiveness Summary.

Table 8-4
Summary of Remedial Action Alternatives
for the Tarpon Springs Site

Alternative	Effectiveness
1. No Action with Continued Monitoring	
• Under this alternative no remedial action will be conducted at the Site. • Long-term semi-annual groundwater and surface water monitoring will be conducted. • Inspection and maintenance of facility fence to restrict access to Site will be conducted.	• Compliance with ARARs will not be met. • Implementation of this alternative will cause no additional environmental impact. • This alternative will not provide an effective long-term solution for the Site. • Exposure to Site constituents will be limited by access restrictions. • Toxicity, mobility, and volume of contaminants are not changed in this alternative.
2. Institutional Controls	
• Incorporation of features from the No Action with Continued Monitoring alternative with the addition of a caretaker. • Internal fences at the slag processing area and the main pond area. • Placement of deed restrictions prohibiting. - installation of groundwater supply wells. - excavation in designated areas where elemental phosphorus is known to exist. - development of any portion of the property for residential use. - development of any portion of the property for commercial/industrial use unless approved by EPA.	• Compliance with ARARs will not be met. • Implementation of this alternative will cause no additional environmental impact. • This alternative will substantially reduce the risk to human health in the long-term by: - insuring that the surficial aquifer will not be used in the future. - not allowing the Site to be used for residential use. - greatly restricting commercial or industrial future use. • Toxicity, mobility, and volume of contaminants are not changed in this alternative.

Alternative	Effectiveness	
4a and b. Consolidation and Capping		
• Incorporation of institutional controls and waste isolation features from the Consolidation and Cover alternative. However, this alternative provides a cap, rather than a cover soil, over the consolidation area. • The cap will comply with the FDEP regulations for capping solid waste management units.	• Compliance with radiological and capping ARARs. Groundwater quality in the surficial aquifer would improve, but the groundwater and surface water quality criteria ARARs would not necessarily be met. • This alternative will substantially reduce the risk to human health in the long-term by: - isolating waste material from human and ecological contact. - insuring that the surficial aquifer will not be used in the future. - restricting the property to commercial use (Alternative 4a only). • A reduction in the mobility of the contaminants is achieved by excavating the slag processing area and Ponds 39 and 42, and by capping the consolidation area. • Toxicity and volume of contaminants are not changed in this alternative.	• E re c • S st if e e • Ir in al w tl a p e p s

Alternative	Effectiveness	
7a and b. Consolidation, Stabilization, and Cover		
• Incorporation of features from the Consolidation, Capping and Saturated Zone Source Control alternative (with the exception of cover instead of capping) plus the additional stabilization/solidification of all material in the consolidation area. • Stabilization/solidification of all consolidation material would include all soil, pond material, and slag material. In situ stabilization would generally be used for material presently located within the consolidation area; ex-situ stabilization would be performed on excavated material.	• Compliance with radiological ARARs. Groundwater and surface water quality ARARs will also be met, although not immediately. • This alternative will substantially reduce the risk to human health and the environment in the long-term by: - isolating waste material from human and ecological contact. - preventing use of surficial aquifer until the remedial action objectives are achieved. - restricting the property to commercial use (Alternative 7a only). • A reduction in the mobility of the contaminants is achieved by excavating Ponds 39 and 42, and the slag processing area, and by covering the consolidation area. This, in conjunction with stabilizing/solidifying the consolidation material, will prevent further contamination of the surficial aquifer. • Toxicity and volume of contaminants are not changed in this alternative.	• T p c fc o al si s a p al r s • I in al w th a p e p s

9.0 SUMMARY OF SELECTED REMEDY

Based upon the comparison of alternatives in the feasibility study (FS) and upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, EPA has selected Alternative 5b (Consolidating, Capping, and Zone Source Control - Residential Use Scenario)for the Site. The selected alternative for the Site is consistent with the requirements of Section 121 of CERCLA and the NCP. Based on the information available at the time, the selected alternative represents the best balance among the criteria used to evaluate remedies. The selected alternative will reduced the mobility and contain the toxicity of the contaminants at the Site. In addition the selected alternative is protective of human health and the environment, will attain federal and state ARARs, is cost effective, and utilizes permanent solutions to the maximum extent practicable. The estimated present worth cost of the selected remedy is $9,356,000 and will take approximately 3 years to complete.

Actual or threatened release, if not addressed by the implementation of the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

9.1 Major Components of the Selected Alternative

The selected remedy includes Institutional Controls, Excavation/Consolidation, Capping, and Saturation Zone Source Control. Institutional Controls in the form of deed restrictions must be placed on the consolidation area to prevent any construction or other activity that would threaten the integrity of the selected remedy. A buffer zone (as determined in the Remedial Design) must be established around this consolidation area to limit access to this area. Since the contamination will be removed from the other areas of the Site and consolidated, these other areas which comply with the Performance Standards will not require institutional control; however, the property owner may voluntarily place deed restrictions or land use restrictions on the Site property. Site fences and security must be maintained at an adequate level to ensure the security of the Site and its remedy. The surface water must be monitored to ensure the source control remedy continues to be effective. All waste material and soil that exceeds any of the Performance Standards for the Site (Table 9-2) must be excavated and consolidated in the several consolidation areas. One of the possible consolidation areas includes the areas where the clarifier is found, the water tower area, the power house area, and the area where Ponds 44 through 51 are located..

This is the first of two operable units planned for the Site. This action addresses the source of the soil contamination by treating and containing the source material.

The major components of the selected remedy include:

- Excavation of radiologically and chemically contaminated material/soil which exceed Residential Cleanup Standards.
- Consolidation of the radiologically and chemically contaminated material/soil in the main

Table 9-1
Performance Standards: Remedial Goals

Soil/Waste Contaminant	Maximum Concentration Detected (mg/kg)	Remedial Cleanup Goals (mg/kg)
Arsenic	127	#
Antimony	32.3	28.1
Beryllium	1.6	0.192
Elemental Phosphorus	0.854	1.4
Thallium	13.4	1.4
Radium-226 (Lead-210)*	73.8 pCi/g	5 pCi/g
Total CPAHs **	-	0.089

* Note that this cleanup level is measured above the background (normal) concentration. The background (normal) concentration will be established during the Remedial Design.

** Total CPAHs include Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene. Dibenzo(a,h)anthracene, and Indeno(1,2,3-cd)pyrene.

\# EPA Region 4 regulates arsenic in soil as a systemic toxicant with a reference dose of 0.0003 mg/kg/day. The safe soil level for residential use that would not exceed this RfD for a child was determined in the Site's risk assessment to be 21.1 mg/kg. EPA also considers arsenic to be a carcinogen in the form that may occur in drinking water and has included an oral slope factor in its IRIS database. The application of the slope factor here, though not considered appropriate, would yield a calculated safe soil level for a child at the most protective 10^{-6} risk level of 0.46 mg/kg. The latter soil cleanup level for arsenic is likely to be achieved since soil containing arsenic above this level also contains other contaminants that will require remediation.

The Remedial Goals have been derived from the Final Baseline Risk Assessment with the exception of Radium-226 which has been establish in accordance with the relevant and appropriate requirement (Federal Standards for the Cleanup of Land and Buildings Contaminated with Residual Radioactive Material 40 CFR 192).

Chemical-Specific ARARs
Performance Standards are consistent with the ARARs identified in Table 8-3.

Action-Specific ARARs
Performance Standards are consistent with the ARARs identified in Table 8-2.

Location-Specific ARARs
Performance Standards are consistent with the ARARs identified in Table 8-1.

The selected remedy is protective of species listed as endangered or threatened under the Endangered Species Act . The requirements of the Interagency Section 7 Consultation Process b50 CFR Part 402, will be met. The Department of Interior, Fish and Wildlife Services, will be consulted during the Remedial Design to ensure that the endangered and threatened species are not adversely impacted by the implementation of the remedy.

Waivers
Waivers are not anticipated at this Site at this time.

10.3 Cost Effectiveness

After evaluating all alternatives which satisfy the two threshold criteria, protection of human health and the environment and attainment of ARARs, EPA has concluded that the selected remedy, Alternative 5b affords the highest level of overall effectiveness proportional to its cost. Section 300.430(1)(ii)(D) of the NCP also requires EPA to evaluate three out of five balancing criteria to determine the overall effectiveness: long-term effectiveness and permanence; reduction of mobility, toxicity, or volume through treatment and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective. The selected remedy provides for overall effectiveness proportional to its cost.

The selected remedy has a moderate present worth, capital, and operation and maintenance cost compared to other remedies, and best satisfies the criteria for long-term effectiveness and permanence and short-term effectiveness. This alternative will reduce toxicity, mobility, or volume through treatment.

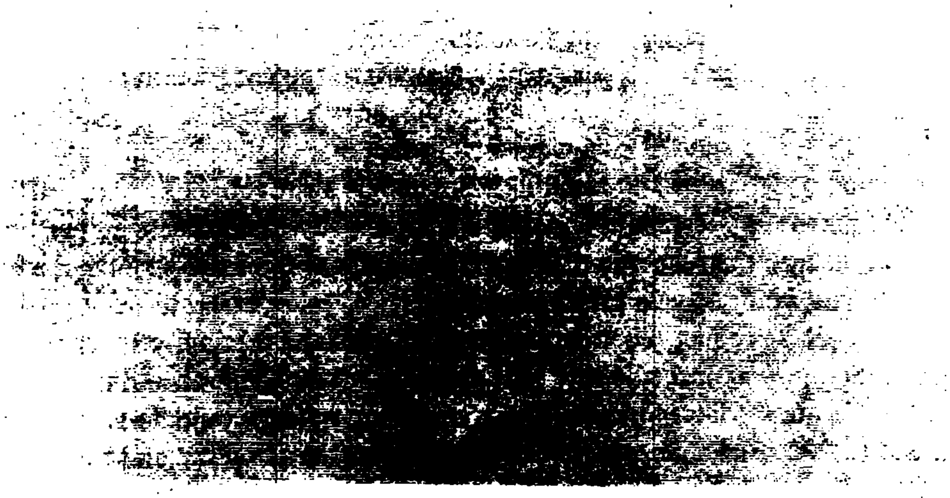
The estimated present worth costs for the soil/source selected remedy is $9,356,000.

10.4 Utilization of Permanent Solution to the Maximum extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final remediation at the Site. Of those alternatives that are protective of human health and the environment and comply with the ARARs, EPA has determined that Alternative 5b provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction of toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment.

Responsiveness Summary

Appendix A



Comment #1: Several comments stressed that the material should not be moved. They stated that it should be left in place and "not disturbed".

EPA Response #1: One of the nine balancing criteria used to evaluate the selected remedy is the **Reduction in Toxicity, Mobility, or Volume through Treatment**. The consolidation and solidification/stabilization is needed to fulfill this requirement. To address the communities concern, EPA has modified the remedy proposed in the Proposed Plan by creating more than one consolidation area. By making this change, the movement of hazardous substances is kept to a minimum. Some movement of hazardous substances will be necessary to bring the Site from an uncontrolled state to a controlled state.

Comment #2: Several letters expressed concerns about the health and welfare of the children, faculty, and staff at Gulfside Elementary School.

EPA Response #2: Every practical precaution will be taken to ensure the safety of the children, faculty and staff at the elementary school. Also, precautions will be taken to protect the surrounding residents.

Comment #3: Many of the comments received during the public comment period were related to the Remedial Design (top cover design, engineering controls, real-time air monitoring, siren/alarm, dust suppression, etc.).

EPA Response #3: EPA will address all issues that pertain to the Remedial Design during the next phase of the Superfund process. Design details and specifications will be presented in the Final Remedial Design.

Comment #4: A number of letters commented that EPA should remove the hazardous material from the Site either by sea, by rail, or by truck.

EPA Response #4: As presented previously in the feasibility study, off-site disposal was eliminated through the screening process. First, the excavation and removal of all contaminated hazardous substances would not be protective of human health and the environment. In fact due to the presence of elemental phosphorus and radium-226 which is air reactive, the excavation of all hazardous substances and contaminated soil would create an even greater hazard than the one that currently exists at the Site. Contaminated substances would have a greater opportunity to be released to the atmosphere. Second, the cost as documented in the feasibility study make the option impractical (the low cost estimate = $200 Million and the high cost estimate = $1.6 Million). Third, the truck traffic would be extremely high (15,000 trucks per year). Fourth, transportation by rail and by truck would unnecessarily expose or potentially expose residences in Tarpon Springs and other communities to hazardous substances. Finally, after considering all of these factor, EPA views the off-site alternative as inappropriate and unsafe. EPA rejects this alternative.

Comment #5: A few comments mentioned the fact that EPA's decision was based on old demographic data. Also, many commented that they felt that residential cleanup standards should be used.

EPA Response #5: EPA has made the decision to use residential cleanup standards which are the most conservative available. The fact that EPA is using the most stringent standards possible makes the question of demographics irrelevant.

Comment #6: A few groups asked EPA to extend the public comment period.

EPA Response #6: EPA granted an extension from August 29, 1996, until September 16, 1996.

Comment #7: Several people commented that the height and the aesthetics of the consolidation area were unacceptable.

EPA Response #7: In an effort to provide flexibility in the design and to minimize the release of hazardous substances to the environment, EPA has added flexibility to the ROD to allow more than one consolidation area to be created. A final decision concerning the number of consolidation areas will be decided during the Remedial Design phase.

Comment #8: A few comments were made concerning the groundwater (the surficial and the Floridan aquifers).

EPA Response #8: Since groundwater will not be addressed by this operable unit, comments concerning the groundwater will be addressed in a subsequent (second) Record of Decision.

Comment #9: One person commented that the consolidation area may collapse into the Floridan Aquifer.

EPA Response #9: The hydro-geologic studies that have been performed do not indicate that this is a likely outcome. On the contrary, the semi-confining layer should support the consolidation areas proposed for the Site. There is no evidence that the consolidation areas will created an unnecessary burden on the confining layer.

Comment #15: One letter suggested several action levels for different chemicals of concern.

EPA Response #15: EPA considered all suggestions; however, no changes were recommended by the EPA which are less stringent than the 1×10^{-6} risk level.

Comment #16: One group asked where the slag material generated at the Site was transported?

EPA Response #16: Some slag material remains on-Site and will be consolidated with other contaminated materials. EPA is currently investigating the off-Site locations where the Stauffer material may have been deposited.

Comment #17: One group stated that there has never been a health survey to determine how many people were affected by this Site.

EPA Response #17: The Agency for Toxic Substance and Disease Registry (ATSDR) is the agency that addresses health related issues. ATSDR has begun the notification process. The notification process included contacting the former employees of the Site and informing them that the Site is on the National Priorities List.

Comment #18: Another group asked - Can it be guaranteed without a shadow of a doubt that no contamination exists on the areas not included in the remediation plans including the groundwater beneath them?

EPA Response #18: Although EPA does not provide guarantees, EPA has conducted extensive sampling of soil and groundwater. EPA will outline specific plans to cleanup the soil within the RD. Remediation of the groundwater will be handled through a separate ROD (Operable Unit 2).

Comment #19: Another group asked - What has been the experience of dealing with similar phosphate site? Where are these sites and how have they been cleaned up?

EPA Response #19: EPA Region 4 has consulted with other Region's that have handled similar phosphate sites and has considered the information received in formulating cleanup options for this Site. However, it is EPA's policy not to directly compare one site to another, but instead to judge each site on a site-specific basis using the Nine Criteria evaluation method as specified by the National Contingency Plan, 40 CFR 300.430.

Comment #20: Another question asked - What will be the effect of the proposed

Comment #26: Another question asked - Who will decide who will perform the remediation work?

EPA Response #26: This question will be determined once the Consent Decree negotiations for the Remedial Design/Remedial Action are completed. If a Potentially Responsible Party (PRP) signs the Consent Decree, then the PRP will conduct the RD/RA with EPA oversight.

Comment #27: Finally, one group asked - Since it appears that many questions cannot be answered before the RD, how can the best option be chosen?

EPA Response #27: Many of the questions posed to EPA can only be answered when the final RD is written and approved. As stated earlier, the nine criteria comparative analysis was used to evaluate cleanup alternatives.

IV. Remaining Concerns

EPA believes that all relevant issues that have been raised are addressed in this responsiveness summary.

EXPLANATION OF SIGNIFICANT DIFFERENCE
SUPERFUND FACT SHEET
AUGUST 16, 1999

Stauffer Chemical Company SiteTarpon Springs, Pinellas County, Florida

INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is issuing this Explanation of Significant Difference (ESD) to provide notice of modifications and clarifications to the cleanup decision document for the Stauffer Chemical Company/Tarpon Springs **Superfund** Site. EPA signed the **Record of Decision (ROD)** in July 1998, selecting the remedy for Operable Unit #1 (OU1), which addresses the soils at the Stauffer facility. This ESD: 1) Raises the remedial cleanup goal for Beryllium based upon the latest research findings and a subsequent change in the remedial cleanup standard for beryllium by both the EPA and the Florida Department of Environmental Protection (FDEP); 2) Updates a citation of the Florida Administrative Code regarding performance standards for the caps to be placed over the consolidation areas; 3) Modifies the performance criteria for the binding mixture to be used in the solidification/stabilization process; and 4) Clarifies the scope of a petroleum products contamination assessment to be performed in coordination with the State of Florida. These modifications do not fundamentally change the selected remedy. The remedy remains fully protective of human health and the environment.

EPA is issuing this ESD as a fact sheet in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 **(CERCLA)**, as amended. CERCLA is known as the **Superfund** law, and the NCP contains the regulations setting forth how EPA will carry out its responsibilities under Superfund. Terms in **bold** are defined in a glossary on page 3.

This ESD will become part of the **Administrative Record** for the cleanup decision for the Stauffer Chemical Company Superfund Site. The record is available for review at the **Information Repository** located at:

Tarpon Springs Public Library
138 East Lemon Street
Tarpon Springs, FL 34689
(727) 943-4922

Background

The Stauffer Chemical Company Tarpon Springs Superfund Site (Site) is located on Anclote Road in
Tarpon Springs, Pinellas County, Florida. This

 Exhibit #4

FLORIDA DEPARTMENT OF HEALTH

Jeb Bush
Governor

Robert G. Brooks, M.D.
Secretary

December 1, 1999

Congressman Michael Bilirakis
9th District, Florida
1100 Cleveland Street, Suite 1600
Clearwater, FL 33755

RE: Questions for EPA Ombudsman

In response to your invitation for questions and lists of concerns, the following have been prepared. While we as the Pinellas County Health Department are not a lead agency, the community has come to us with questions, to which we have tried to respond. In summary, we want to see the site cleaned up as soon as possible, but our review of the limited amount of data available to us at the Tarpon Springs library has raised concerns that should be brought to your attention.

DISCREPANCIES BETWEEN INVESTIGATIONS

The scope of work designates the Weston Report of December 1993 as a reference document for use during the cleanup phase. A number of statements in the Weston report seem inconsistent with both the ROD and an earlier NUS report. The PCHD does not have adequate resources to completely explore apparent discrepancies, but we feel they should be explained and reconciled if the Weston report is to be cited for any cleanup work:

1. **Hydraulic Conductivity:** Weston reports they found the hydraulic conductivity of the surficial aquifer consisting of "permeable sands extending to the top of the confining unit" as between 164 and 344 ft/day (Pg 4-45). An earlier report by Seaburn and Robertson (1987) reported a hydraulic conductivity for the surficial aquifer that ranged from 0.62 ft/day to 2.0 ft/day, while the ROD uses 23 ft/day with no citation provided. This number is important as it factors into numerous conclusions.

2. **Confining Layer:** The extent of a confining layer between the surficial and Floridan aquifer also bears heavily on the migration of contaminants.

EPA instructed Weston to evaluate the connection between the surficial and Floridan aquifer with a pump test of 48 hours or more. (Maxwell Kimpson, 12/17/92) This required two wells: the one that is pumped must penetrate the Floridan aquifer, and the drawdown effect measured in a nearby surficial well. Weston however pumped out of a surficial well (MW 93-4, 20 ft deep, Pg 3-30 etc) with no Floridan well mentioned. This test was terminated after 24 hours, due to excessive drawdown. Weston states they evaluated the results using the Theis equation that assumes a relatively non-leaky aquifer-confining layer. Although the test was not performed as stipulated, the quasi-results are used as though they met the requirements of Mr. Kimpson's request and the Theis equation.

A single Hydraulic Conductivity test of the confining layer was analyzed, and the specimen was described as silty, clayey *sand* usually with a hydraulic conductivity of 10^{-2} to 10^{-3} m/d, but then report a hydraulic conductivity factor for massive clay of 9.75×10^{-5} m/d.

Weston concludes this confining layer extends across the entire site, described as being from 0.25 to 6 ft thick. Another way of stating the same fact was that from the limited number of borings the confining layer was found to be as little as 3 inches thick. With the anticipated variability on the site,

Tel: (727) 538-7277 • Environmental Engineering • Fax: (727) 538-7293
4175 East Bay Drive, Suite 300, Clearwater, FL 33764

three inches hardly seems enough to conclude the confining layer underlies the entire site. We believe many additional samples should be collected to better define the extent of the confining layer and hydraulic conductivity.

3. Direction of Underground Flow: Knowledge of flow direction greatly changes many assumptions, particularly monitor well siting, interpretation of peziometric data, and determining where pollution could spread.

Weston states "Groundwater flow in both the surficial and Floridan aquifers in the vicinity of the site is southwest discharging into the Anclote River." and "The Floridan aquifer has not been impacted as a result of past activities due to the predominately horizontal flow in the surficial aquifer and the presence of a semi-confining sandy clay to clay unit which was found across the site." (Pg ES-8). Weston Figure 4-11 shows a peziometric surface for the Floridan aquifer flowing to the south and southwest. On review by our staff, and according to table 3-3, only 3 of the wells were suitable for use in calculating groundwater flow, and based on these three wells the flow direction was calculated as being towards the west and northwest!

Data from other sources indicate a very complicated underground flow pattern in the area, a pattern that would be effected by local drawdown (see Attachment). The Weston report ignores current and possible future use in the area as a factor on flow direction. There are several wells near the site that have or can be used for manufacturing of concrete and other potentially large demands, and several public utility wellfields. Drawdown from these sources would be expected to significantly change flow patters, as can be seen in Attachment 1.

On the issue of nearby wells, NUS (1988) in Table 2-2 clearly notes the two public wellfields within 3000 ft of the site that at the time served nearly 40,000 people. Apparently by using another definition of distance which conveniently starts at the centroid of the Stauffer Site (thus assuming all pollution occurs at one location), Weston simply states the nearest public wells are one to two miles away.

We have significant concerns regarding the conclusion that underground flow terminates at the Anclote river. Deeper surficial waters, waters under the confining layer, and waters influenced by tidal fluctuations, would not be intercepted by the river, and could pollute down-gradient shallow and deep wells.

4. Additional Monitoring Wells: In general, we are concerned that not enough monitoring wells have been installed to adequately evaluate the site.

While there are many "dots" on the map, many seem inappropriately sited based on incorrect assumptions regarding flow direction.

EPA requested (correspondence dated November 24, 1992) additional monitor wells, needed in the central portion of the site, adjacent to the slag processing areas and adjacent to all ponds on-site. EPA stated, the number of shallow monitor wells on-site does not adequately assess groundwater contamination at this site. Furthermore, EPA requested two monitor wells, one between Pond 42 and Myers Cove and one approximately 450 feet south of the first well. Weston installed one additional monitor well, based on their original plan, located approximately 450 feet north of their proposed well MW93-3 (located south of Pond 42). Why were no additional monitor wells installed?

MCL's were reported in deep monitor wells in the NUS Corporation Report 1988 (see Attachment 2). Why were there no deeper monitor wells installed to determine the vertical extent of the contaminate plume?

How can monitor wells MW-1F. MW-1S, and MW-7ES be considered background sample points when no monitor wells bound Pond 39, in order to delineate pond materials potential to impact groundwater?

Historically, Pond 50 has been evident on site as early as 1965, as seen in the aerial photographs. To date, it appears the only analysis conducted on Pond 50 was for elemental phosphorus. EPA (correspondence dated November 24, 1992) recommended that TCLP leachablity analysis and all parameters of concern be completed on all of the ponds. EPA stated that it appeared that the pond soils were selectively sampled. The Weston (1993) report finds Pond 50 to have the largest volume of elemental phosphorus containing material (Table 3-2) and still the pond soils were not sampled. Why has there been no testing of either soils or groundwater in the vicinity of Pond 50?

ADDITIONAL ISSUES & CONCERNS

1. Sinkholes: Apparently no subsurface investigation for sinkholes has been performed, although this area is acknowledged to be within an active sinkhole zone. It is remotely possible that sinkhole channels could explain high readings for Thallium found off-site, providing other routes for the transport of contaminates. The development of a sinkhole in the area after remediation could be catastrophic.

The USGS survey of the area (Fretwell, 1988, Report 87-4188) places southwestern Pasco County in a high potential zone for sinkhole development (see Attachment 3). Zone 4 is described as "Cover is 25 to 100 ft thick consisting of sand overlying clay. Numerous sinkhole lakes, cypress heads, and cove-collapse sinkholes dominate."

Numerous sinkholes exist in this area, including one about two miles long from Lake Tarpon to Spring Bayou in downtown Tarpon Springs (see Attachment 4).

The material added for in-situ consolidation may increase the overburden weight by 10% or more, and mounding will add significantly more weight that could cause sinkholes to form.

2. Separation of Operating Unit 1 from Operating Unit 2: In our opinion the surface remedy and subsurface remedy are so intrinsically interconnected that they cannot be separated. Runoff from the cover, effect of the consolidation monoliths to changes in underground flow, and changes in use / infiltration in the area will all have a significant bearing on both the surface and subsurface solutions.

3. Construction of Impermeable Cover: Information from other sites raises concerns that such covers, no matter how thick, will become permeable over time. If this site is to be a natural area or golf course, rodents, tortoises, insects, trees, and other vegetation would be expected to penetrate the cover.

Construction tolerances are of concern. Personal experience has taught engineers how difficult it is to construct and maintain cover tolerances over large areas.

Long-term (i.e. 500 years) maintenance of such an impermeable cover is also a concern. Long-term changes of use, weather, aging, and perhaps sea level changes will surely influence the cover thickness and integrity.

Runoff from the impermeable cover layer should be directed so that it augments the hydraulic gradient away from habitable areas.

4. In-Situ Consolidation: Several questions are raised as to special considerations found at this location, and thus the suitability of in-situ consolidation here.

Has this in-situ remedy previously been successfully implemented in a high groundwater table with close proximity to a tidally influenced and rapidly fluctuating river environment?

Has the saltwater / freshwater interface in this vicinity been studied? What effect will the in-situ remedial activity have in regards to the inland migration of the saltwater / freshwater interface?

What effects will saline water have on the structure?

What effect does the drawdown of nearby pumping wells have now on the migration of the contaminates and what effect will the placement of a less permeable obstruction have to future drawdowns?

We would like to see more information from similar previous work. One item in particular is a scientific explanation as to why the in-situ stabilization in Shattuck, CO. failed, and confirmed instances where such work has succeeded.

5. **4-mile Radius:** Somehow references and solutions focus on Pinellas County, while Pasco County is similarly affected, being adjacent to the site. The general standard is that investigations be made in a 4-mile radius around the site. That later became 3 miles, and at this point only concerns adjacent to the site seem worthy of meriting attention.

6. **Leachability Report,** Parsons Engineering, November 1997 (Received July 19, 1999): This report states no impact to groundwater, without installing monitor wells in the slag areas. Since the slag was deposited in these areas over a decade before this study began, why were there no wells installed to define any potential impact to groundwater?

A pancake probe as used on this site is typically used for detecting alpha particles. In this investigation it was held 12 inches above the surface. However since alpha particles only travel 1 to 2 inches in air, this probe would be expected to read only gamma particles.

7. **Existing Industrial Well**, reportedly 305 feet deep. When was it abandoned? This well was reportedly located approximately 300 feet east of the main office (Heath and Smith, 1954, USGS Report #12). Since well casings have in the past been conduits from the mobilization of contaminants, have any studies been conducted in this area to identify any environmental impact? Was this well, or any well located on-site, ever utilized as an injection well?

PENDING REQUESTS FOR ADDITIONAL INFORMATION

After PCHD staff had identified most of the above concerns, a search uncovered correspondence from Kenneth W. Brown, Manager, EPA Technology Support Center to Maxwell J. Kimson, November 13, 1992 which identified many of the same problems. We have been unable to locate any response to these questions.

Five questions regarding groundwater flow direction were sent to John Blanchard, October 17, 1999. Mr. Blanchard has since advised us a Hydrogeologist has been hired to look at these questions. It is our understanding the person is to only spend a week at the site. Unless very familiar with local geology, it is hoped the Hydrogeologist's stay can be extended to enable a complete understanding of the area.

Nine very technical questions regarding the local and regional hydrogeology were sent to John Blanchard, November 16, 1999. It would seem reasonable the Hydrogeologist mentioned above could address these questions.

ASSURANCES OF FINAL CONSTRUCTION

To date, we have available to us only general descriptions of the work to be accomplished. What input would we have into the final construction plan?

What assurances exist that construction will in fact be performed as agreed upon? Reports from other sites are not reassuring.

For instance, a critical aspect for the construction of the in-situ consolidation monolith is that a second set of borings be constructed between the first set, thus filling in the approximately 40% void consisting of uncemented material. We are told that at the Brunswick, GA. Site, the EPA approved the elimination of the additional borings without notice after the first sets were installed.

LOCAL COMMUNICATION

It should be noted that much important information is not available to us at the local level, which leaves the impression that important facts are being withheld:

We have no Scope of Work. Mary Mosley obtained a DRAFT copy from John Blanchard on May 3, 1999, which she then faxed to us on Aug. 8, 1999. There has yet to be a final scope of work, and even this document does not provide detailed information as to what work is actually planned. For instance, there are no details of the proposed cover cap or materials to be used.

The consent decree will not be filed until Dec. 2, the day of this hearing, and no one locally seems to have seen a draft copy. Thus the PRP and EPA come into this presentation with knowledge others don't possess.

The Tarpon Springs Library is designated as an Official Repository for all information related to this site. At the November 16th meeting with Tim Fields at the Tarpon Springs Library, EPA staff viewed the material, which occupies about 11 ft. of shelf space, 2 ½ shelves and assured us that the repository contains all available information. At the urging of EPA staff we later searched the EPA web site for 3 hours without finding significant information related to the Stauffer site. Since then, Kevin Peg, the Consultant for PiPaTag , has advised a small room full of correspondences and information has been produced, and we have less than a third of what is available.

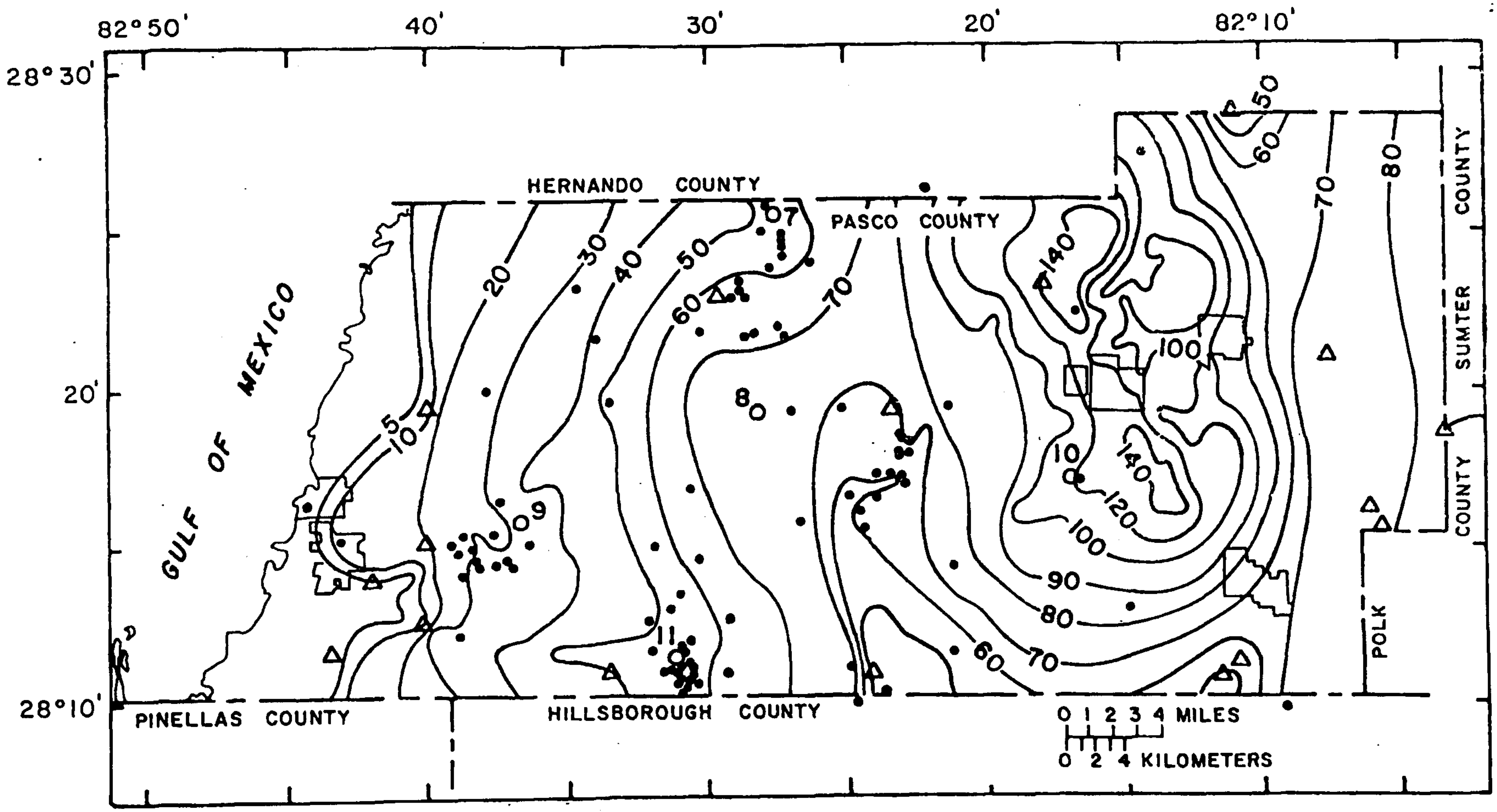
The only local group with which EPA maintains contact is PiPaTag. While we can not assume a leadership role in this work, we again request to be provided all information and correspondence, and an opportunity to make constructive comments as plans are being developed.

Sincerely,

D M Flanery

D. Michael Flanery, P.E.
Director, Environmental Engineering

cc: FL Sen. Jack Latvala
FL Rep. Heather Fiorentino
Dr. J. P. Heilman, Director Pinellas County Health Department
Sharon Heber, Director Environmental Health
Beth Copeland, ATSDR
Dr. Mark Yatch, Director Pasco County Health Department
Ken Swann, Pasco County Health Department
Richard Hosking, Assnt. Director Pasco County Health Department
David B. Struhs, Sec FDEP
John Blanchard, EPA
Mary Mosely, C.A.U.S.E.D.
Rose Mary Ammons, Pi-Pa-Tag



EXPLANATION

—20— LINE OF EQUAL WATER-TABLE ELEVATION ABOVE SEA LEVEL IN SEPTEMBER 1984
CONTOUR INTERVAL 5 AND 10 FEET

O11 SEDIMENT SAMPLING SITE AND SITE NUMBER (table 5)

• SURFICIAL AQUIFER WELL SITE

Δ GAGING STATION FROM WHICH WATER LEVELS WERE DETERMINED

Figure 23.--Locations from which sediment samples were collected and estimated elevation of the water table in Pasco County in September 1984.

(Fretwell, J.D, 1988, USGS Water-Resource 87-4188)

TABLE 4-19

SUMMARY OF INORGANIC ANALYTICAL RESULTS
FLORIDAN AQUIFER MONITOR WELL SAMPLES
STAUFFER CHEMICAL COMPANY
TARPON SPRINGS, FLORIDA

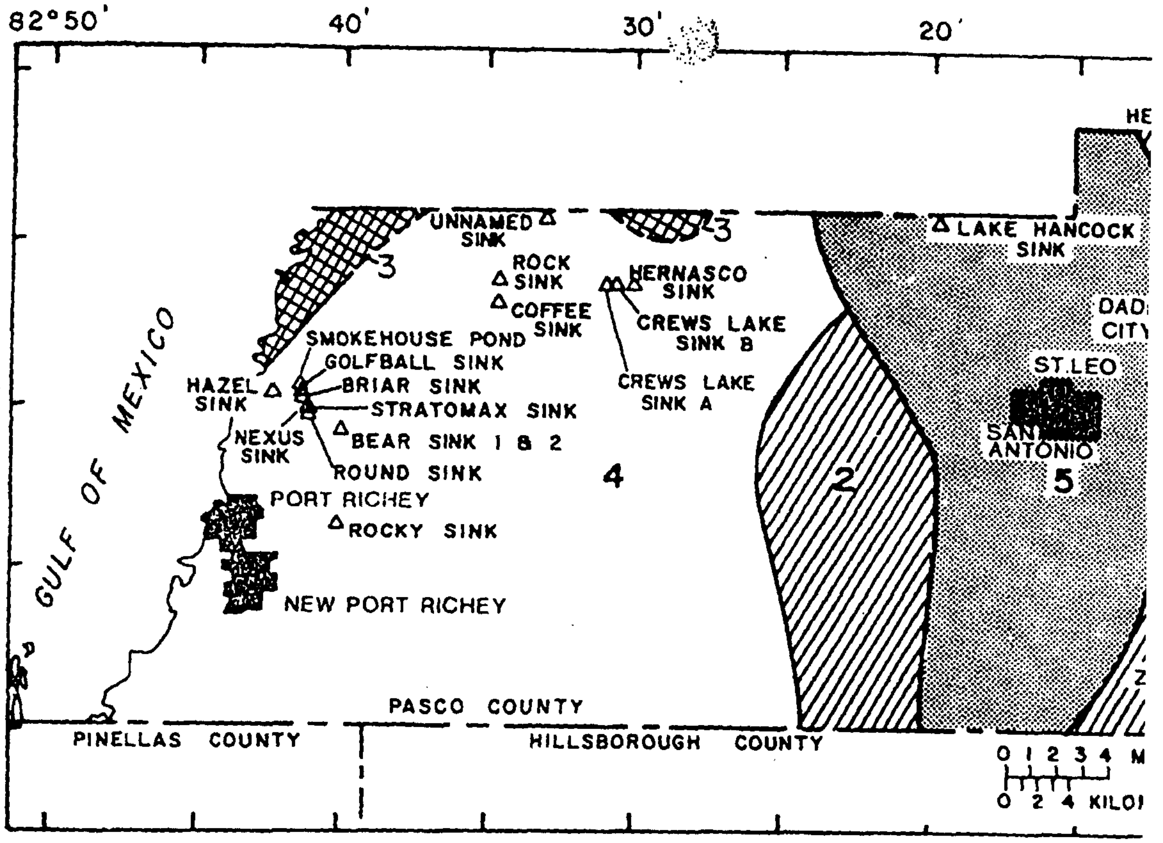
PARAMETERS (ug/l)	Background MW-01F	Calcium Fluoride #3 MW-02F	SE Property Boundary MW-03F	Across River MW-04F
SILVER	-	-	-	-
ARSENIC	-	19	4JN	110JN
BARIUM	24J	23J	21J	340J
BERYLLIUM	-	-	-	5
CADMIUM	-	-	29	-
COBALT	-	-	-	35
CHROMIUM	-	-	-	290
COPPER	-	-	320	44
NICKEL	-	-	12	200
LEAD	-	-	-	-
ANTIMONY	-	-	-	-
SELENIUM	-	-	-	-
TIN	NA	NA	NA	NA
THALLIUM	-	-	2JN	-
VANADIUM	5	-	14	320
ZINC	-	-	-	210
MERCURY	-	-	-	-
ALUMINUM	81	34	690	74,000
MANGANESE	12	57	30	5200
CALCIUM	73,000	130,000	110,000	710,000
MAGNESIUM	11,000	110,000	48,000	210,000
IRON	39	230	860	110,000
SODIUM	65,000	690,000	380,000	69,000
POTASSIUM	2300	56,000.	28,000	28,000
CYANIDE	R	R	R	R
FLUORIDE (mg/l)	-	-	-	-
TOTAL PHOSPHORUS (mg/l)	-	-	NA	27J

- \- Material analyzed for but not detected
- J Estimated quantity
- N Presumptive evidence of presence of material
- NA Not analyzed
- R Data rejected due to quality assurance review

TABLE 4-21

SUMMARY OF RADIOLOGICAL ANALYTICAL RESULTS
FLORIDAN AQUIFER MONITOR WELL SAMPLES
STAUFFER CHEMICAL COMPANY
TARPON SPRINGS, FLORIDA

PARAMETERS (pCi/l)	Background MW-01F	Calcium Fluoride #3 MW-02F	SE Property Boundary MW-03F	Across River MW-04F
GROSS ALPHA, TOTAL	2+/-2	20+/-20	3+/-6	140+/-30
GROSS BETA, TOTAL	4+/-1.5	63+/-14	15+/-8	113+/-13



EXPLANATION

ZONE 2 — BARE OR THINLY COVERED LIMESTONE. LITTLE RECHARGE. HIGH SURFACE RUNOFF. SINKHOLE DEVELOPMENT IS RARE

ZONE 3 — INCOHESIVE SAND COVER. H FEW SINKHOLES, BUT LIME SINKHOLES DOMINATE

ZONE 4 — COVER IS 25 TO 100 FEET THICK CONSISTING OF SAND OVERLYING CLAY. NUMEROUS SINKHOLES, SINKHOLE LAKES, AND CYPRESS HEADS. COVER-COLLAPSE SINKHOLES DOMINATE

ZONE 5 — COVER IS 25 TO 150 FEET IS UNDERLAIN BY A THICK DRAINAGE IS COMMON. CO COVER-SUBSIDENCE SINKH

Figure 22.--Zones of different sinkhole types (modified from Sinclair and larger sinkholes known or suspected to have connections to the aquifer (modified from Trommer, 1987).

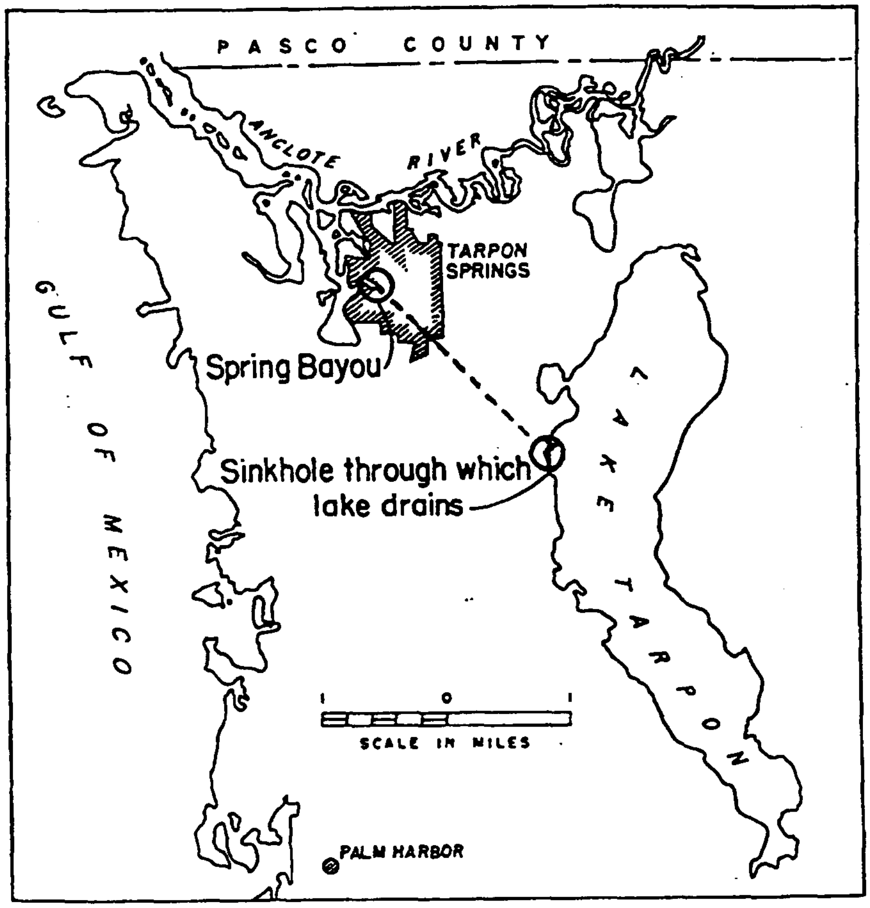


Figure 18.—Map of northwestern Pinellas County showing locations of Spring Bayou and Lake Tarpon.

(Heath & Smith, 1954)

former elemental phosphorus plant is located on Anclote Road near the Pinellas/Pasco County border, and lies along the Anclote River two miles upstream from the Gulf of Mexico. The town of Tarpon Springs is located 2 miles southeast of the Site. The Site comprises approximately 130 acres and includes the former phosphate processing area, elemental phosphorous production facilities, and office/administrative buildings. While operating, the plant used seventeen unlined waste ponds on the Site. Land use in the surrounding area includes light industrial, commercial, and residential. There are undeveloped areas near the Site. The Site is generally flat with an average elevation of 10 feet above sea level.

EPA placed the site on the **National Priorities List (NPL)** in 1994. In February 1992, the Stauffer Management Company (SMC) voluntarily entered into an Administrative Order on Consent (AOC) with the EPA. SMC completed a detailed study (Remedial Investigation and Feasibility Study or RI/FS) in 1996, under an EPA AOC. This study evaluated the contamination at the Site, determined the potential risks, and identified and evaluated methods for remediating the contamination. EPA selected a remedy to address the site soils in the ROD. SMC is managing the Site on behalf of Rhone-Poulenc, Inc.

SCOPE OF ESD

The ROD calls for consolidation of contaminated soils and sediments at the Site under OU 1. This ESD: 1) Raises the remedial cleanup goal for beryllium in soils at the Site; 2) Updates a citation of the FAC regarding the performance standards for caps; 3) Modifies the performance criteria for the solidified/stabilized waste material
4) Clarifies the scope of a contamination assessment to be performed for the FDEP to address petroleum products.

Selected Remedy for OU1

The major components of the soil operable unit include:

- Limited excavation of radiologically and chemically contaminated material/soil which exceed Residential Cleanup Standards.
- Consolidation of contaminated material/soils in the main pond area, slag area, and/or other areas on-site.
- Placement of institutional controls on the Site to include deed restrictions, land use ordinances, physical barriers, and water supply well permitting restrictions.
- In-situ Solidification/Stabilization of pond material and contaminated soil below the water table in the consolidation areas.

Explanation of Significant Difference (ESD)

This ESD presents the following modifications to the ROD:

1) The ROD identified beryllium as a contaminant of concern and provided a cleanup goal of 0.192 parts per million (ppm) in soils, based upon future residential use. This cleanup goal was selected during the development of the Baseline Risk Assessment, which was completed in July 1995. At this time, the driver for 0.192 ppm cleanup goal was the carcinogenic effect of beryllium via soil ingestion. In April 1998 EPA determined that beryllium is carcinogenic only via the inhalation pathway. Therefore, the remedial cleanup goal is governed by the non-carcinogenic effects of soil ingestion. EPA established a remedial cleanup goal of 160 ppm for beryllium in soils at its Superfund sites and the FDEP established a remedial cleanup goal of 120 ppm for beryllium in soils at their sites.

EPA is raising the cleanup goal for beryllium to 120 ppm at the Stauffer Chemical Company Superfund Site because this higher level was established prior to the signing of the ROD. EPA and FDEP consider this concentration to be protective of human health and the environment.

Further information on the effects of beryllium can be found in EPA's Integrated Risk Information System dated April 3, 1998.

2) The ROD cites Florida Administrative Code (FAC) 62-701.050 as the performance criteria for top cover caps being placed over the consolidation areas. This reference is no longer in use. The current reference is FAC 62-701.600.5(g). This ESD replaces the former reference with FAC 62-701.600.5(g) to establish the performance criteria for the top cover caps.

3) Page 5 of 61 of the ROD references a contamination assessment to be performed for the FDEP in response to reported soil and ground water contamination in the vicinity of two former above ground fuel oil storage tanks removed in August 1992. Stauffer Management Company performed the contamination assessment and received a release from obligation to conduct site remediation (related to the former tanks) in a March 1994 letter from the FDEP. therefore, this requirement is deleted from the ROD. Instead, the EPA discovered Light Non-Aqueous Phase Liquids (LNAPLs) in monitoring well 93-5; it is suspected that these LNAPLs are petroleum-related. SMC will conduct a contamination assessment for the FDEP to address the LNAPLs and will perform any necessary remediation.

4) Page 57 of 61 of the ROD specifies the following performance requirements for the binding mixture to be used in the solidification/stabilization process: a minimum 100 psi compressive strength and a maximum permeability of 1 x 10^{-6} cm/s. Subsequent research revealed that this standard is applicable to ex-situ solidification/stabilization, but are not applicable to in-situ stabilization. The minimum performance standards for the in-situ solidified/stabilized waste material shall be 50 psi unconfined compressive strength and a permeability of 10^{-5} cm/s respectively, referenced in accordance with " Solidification and Stabilization of CERCLA and RCRA Wastes," EPA/625/6-89/022. May 1989. These are minimum requirements: SMC shall calculate overburden loads, other applicable loadings. appropriate

safety factors: constructibility: and other conditions when determining the actual performance criteria for the solidified/stabilized waste material. These shall be verified through bench scale tests during the design phase.

Statutory Determination

The selected remedy as changed by this ESD for the Stauffer Chemical Company **Superfund** Site **ROD** for OU1 remains protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, and is cost-effective.

Glossary

Administrative Record: Documents providing the basis for EPA's selection of a cleanup remedy at a **Superfund** site; placed in the **Information Repository** near a site for public review.

CERCLA or Superfund: The federal law which establishes and authorizes EPA to respond to abandoned or unregulated releases of hazardous waste.

Groundwater: Water found beneath the earth's surface that fills pores between materials such as sand, soil, or gravel.

Information Repository: Documents located near a **Superfund** site for public review.

National Priorities List (NPL): EPA's list of priority hazardous waste sites that are eligible to receive federal money for response under **Superfund**.

PRP: Potentially Responsible Party - a company or individual who owned or operated a hazardous waste site or has transported or disposed waste to the site.

Record of Decision (ROD): Document explaining EPA's rationale for selection of a cleanup remedy at a **Superfund** site.

Superfund: Common name for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) established to address uncontrolled or abandoned hazardous waste sites.

EPA CONTACTS

John Blanchard, PE, Project Manager
or
Carlean Wakefield, Community Relations Coordinator
South Site Management Branch
EPA - Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303
1-800-435-9234

MAILING LIST ADDITIONS/CORRECTIONS

If you would like your name and address placed on the mailing list for the Stauffer Chemical Company Superfund Site, please complete this form and return to Carlean Wakefield, EPA, 61 Forsyth Street, SW, Atlanta, GA 30303.

NAME: ______________________________

ADDRESS: ______________________________

____

TELEPHONE: ______________________________

AFFILIATION (If any): ______________________________

EXPLANATION OF SIGNIFICANT DIFFERENCE
SUPERFUND FACT SHEET
JUNE 22, 1999

Stauffer Chemical Company SiteTarpon Springs, Pinellas County, Florida

INTRODUCTION

The U.S. Environmental Protection Agency (EPA) is issuing this Explanation of Significant Difference (ESD) to provide notice of a clarification to the cleanup decision document for the Stauffer Chemical Company/Tarpon Springs **Superfund** Site. EPA signed the **Record of Decision (ROD)** in July 1998 selecting the remedy for Operable Unit #1 (OU1), which addresses the soils at the Stauffer facility. This ESD clarifies the remedial cleanup goal for arsenic. The modification does not fundamentally change the selected remedy. The remedy remains fully protective of human health and the environment.

EPA is issuing this ESD as a fact sheet in accordance with Section 117(c) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (**CERCLA**), as amended. CERCLA is known as the **Superfund** law, and the NCP contains the regulations setting forth how EPA will carry out its responsibilities under Superfund. Terms in **bold** are defined in a glossary on page 3.

This ESD will become part of the **Administrative Record** for the cleanup decision for the Stauffer Chemical Company Superfund Site. The record is available for review at the **Information Repository** located at:

Tarpon Springs Public Library
138 East Lemon Street
Tarpon Springs, FL 34689
(727) 943-4922

Background

The Stauffer Chemical Company Tarpon Springs Superfund site (site) is located on Anclote Road in

Tarpon Springs, Pinellas County, Florida. This former elemental phosphorus plant is located on Anclote Road near the Pinellas/Pasco County border, and lies along the Anclote River two miles upstream from the Gulf of Mexico. The town of Tarpon Springs is located approximately 2 miles southeast of the site. The site comprises an area of approximately 130 acres and includes the former phosphate processing area, elemental phosphorous production facilities, and office/administrative buildings. While operating, the plant used a system of seventeen unlined waste ponds on the site. Land use in the surrounding area includes light industrial, commercial, and residential. There are undeveloped areas near the site. The site is generally flat with an average elevation of 10 feet above sea level.

EPA placed the site on the **National Priorities List (NPL)** in 1994. In February 1992, the Stauffer Management Company (SMC) voluntarily entered into an Administrative Order on Consent (AOC) with the EPA. Under the AOC, Stauffer completed a detailed study (Remedial Investigation and Feasibility Study or RI/FS) in 1996, under EPA direction. This study evaluated the contamination at the site, determined the potential risks posed by the contaminations, and identified and evaluated methods for remediating the contamination. EPA selected a remedy to address the site soils in the July 1998 ROD.

SCOPE OF ESD

The ROD calls for consolidation of contaminated soils and sediments at the site under operable unit (OU) number 1. This ESD clarifies the remedial cleanup goal for arsenic in soils at the site.

Selected Remedy for OU1

The major components of the soil operable unit include:

- Limited excavation of radiologically and chemically contaminated material/soil which exceed Residential Cleanup Standards.
- Consolidation of contaminated material/soils in the main pond area, slag area, and/or other areas on-site.
- Placement of institutional controls on the site to include deed restrictions, land use ordinances, physical barriers, and water supply well permitting restrictions.
- In-situ Solidification/Stabilization of pond material and contaminated soil below the water table in the consolidation areas.

Explanation of Significant Difference (ESD)

The July 1998 ROD identified arsenic as a contaminant of concern, but was not clear on the remedial cleanup goal for arsenic. The ROD referenced a "safe soil level" of 21.1 parts per million (ppm) for residential use, based upon non-carcinogenic effects. The ROD stated that the calculated concentration corresponding to the 10^{-6} excess lifetime cancer (carcinogenic) risk for arsenic in soils is 0.46 ppm. The ROD noted that the 0.46 ppm cleanup number would likely be achieved through the remediation of the other contaminants of concern.

This ESD clarifies that the remedial cleanup goal for arsenic in soil is 21.1 ppm at the Stauffer Chemical Company site. The Agency's decision is based on conclusions provided by the Expert Panel of Arsenic Carcinogeneity (Eastern Research Group, May 21-22, 1997), similar cleanup goals selected at a number of other Superfund sites nationally, EPA's belief that the carcinogenic effects of arsenic in soils are negligible at this concentration, and concurrence from the Agency for Toxic Substances and Disease Registry on the protectiveness of the 21.1 ppm goal. Therefore EPA considers the 21.1 ppm cleanup goal selected to be protective of human health and the environment.

Statutory Determination

The selected remedy as clarified by this ESD for the Stauffer Chemical Company **Superfund** Site **ROD** for OU1 remains protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, and is cost-effective.

Glossary

Administrative Record: Documents providing the basis for EPA's selection of a cleanup remedy at a **Superfund** site, placed in the **Information Repository** near a site for public review.

CERCLA or Superfund: The federal law which establishes and authorizes EPA to respond to abandoned or unregulated releases of hazardous waste.

Groundwater: Water found beneath the earth's surface that fills pores between materials such as sand, soil, or gravel.

Information Repository: Documents located near a **Superfund** site for public review.

National Priorities List (NPL): EPA's list of priority hazardous waste sites that are eligible to receive federal money for response under **Superfund**.

PRP: Potentially Responsible Party - a company or individual who owned or operated a hazardous waste site or has transported or disposed waste to the site.

Record of Decision (ROD): Document explaining EPA's rationale for selection of a cleanup remedy at a **Superfund** site.

Superfund: Common name for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) established to address uncontrolled or abandoned hazardous waste sites.

EPA CONTACTS

John Blanchard, PE, Project Manager

or

Carlean Wakefield, Community Relations Coordinator
South Site Management Branch
EPA - Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303
1-800-435-9234

MAILING LIST ADDITIONS/CORRECTIONS

If you would like your name and address placed on the mailing list for the Stauffer Chemical Company Superfund Site, please complete this form and return to Carlean Wakefield, EPA, 61 Forsyth Street, SW, Atlanta, GA 30303.

NAME: ______________________________

ADDRESS: ______________________________

____

TELEPHONE: ______________________________

AFFILIATION (If any): ______________________________